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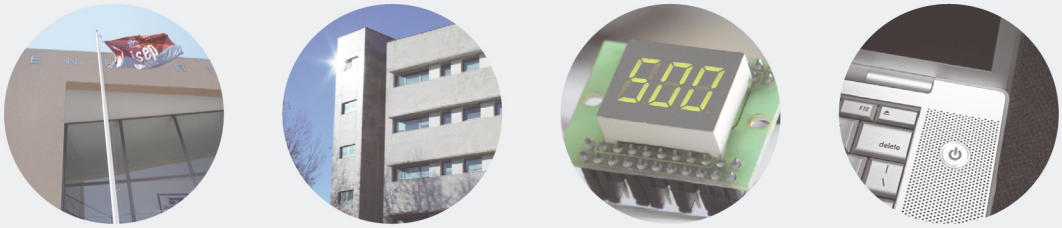

ANALYSIS AND TESTING METHODOLOGY FOR BLUETOOTH AUDIO IN 0KM/FIELD CLAIMED PRODUCTS OF BOSCH CAR MULTIMEDIA PORTUGAL, S.A.

ARAVIND MARIMUTHU

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Department of Electrical Engineering

Master's in Electrical Engineering – Power Systems

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Report prepared for the partial satisfaction of the requirements of DSEE Unit Course – Dissertation of the Master's in Electrical Engineering – Power Systems

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“Where there is righteousness in the heart,
There is beauty in the character.
When there is beauty in the character,
There is harmony in the home.
When there is harmony in the home,
There is order in the nation.
When there is order in the nation,
There is peace in the world.”

- APJ Abdul Kalam

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ABSTRACT

The main intension of the project is to develop and implement a standard test setup and automatic testing scripts to test the Bluetooth module's audio of the 0KM/Field claimed products of Bosch Car Multimedia Portugal, S.A. 0KM/Field claimed products are the products claimed by the automobile companies as malfunctioning before going to the final customers. The work developed in the QMM-FA (Quality Management & Methods – Failure Analysis) department will be used for testing the characteristics of the Bluetooth module's audio to enabling answering the customer's queries as quickly as possible and in a standard way.

Currently testing of Bluetooth modules is achieved by using the mobile phones in the customer mode. Customer mode means that this test is simulates a typical customer scenario and does not follow any internal testing specifications of Bosch. Tests strongly depends on external sources (Mobile phones).

Basically, two types of tests are required to evaluate the quality of the CM products: one is testing and measurement of the characteristics of the products and another one is functional tests. The functional tests are carried out by using mobile phones and QMM-FA is already performing a functional test.

The proposed testing setup is framed by using R&S Audio Analyzer – UPL, R&S Signal Generator, R&S Programmable Power Supply and Bosch BLAUBOX and BLAUKIT. This setup is mainly used to test the audio streaming and other characteristic of the BT module's audio.

Bosch having a diverse variety of CM products maximum of the products are having a Bluetooth module. The developed test plan was implemented in the "NISSAN A IVI SCOPE_1" product. Test script was developed using blk programming codes in BLAUKIT (Bosch's internal platform). All the used

equipment are connected through GPIB connector to configure & acquire remotely.

Notion of this proposed test plan will be the same for all the other 0KM/Field claimed products, only the testing variables and the way of communication with the product's modules are different depends on the product's specification. Bosch standards and specifications are framed according to the customer specification of each product. For "NISSAN A IVI SCOPE_1" product, Bosch Groups already having a set of requirements from the NISSAN Group of companies. In Bosch manufacturing plant, manufactured products should accomplish the customer requirements.

This test setup is framed to test the BT module's audio according to the Bosch testing standards and specifications to ensure the quality and functionality of the Bluetooth audio of "NISSAN A IVI SCOPE_1" product. By using the proposed test plan it enables the claimed product test and analysis the characteristics of the Bluetooth Audio in the stipulated time with automatic testing.

Keywords:

Standard Test Setup, Bluetooth module's audio, 0KM/Field Claimed Products, QMM-FA, Customer Mode, Customer requirements, Bosch Internal Testing Specification, Functional Test, Bosch BLAUBOX & BLAUKIT, Audio Signal, CM Products, and NISSAN IVI SCOPE_1.

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LIST OF ABBREVIATIONS & ACRONYMS

ADC - Analog to Digital Converter
AFH – Adaptive Frequency Hoping
AI – Audio Infotainment
AM - Amplitude Modulation
AMP – Amplifier
ASG – Audio Signal Generator
AUX – Auxiliary
AVM – Audio Visual Management
BB – Base Band
BLE – Bluetooth Low Energy
BR – Basic Rate
EDR - Enhanced Data Rate
BrgP – Bosch Car Multimedia Portugal, S.A.
BT – Bluetooth
BT_SIG – Bluetooth Special Interest Group
BU – Business Unit
CAN – Controller Area Network
CD – Compact Disc
CH1/CH2 – Channel 1 / Channel 2
CM – Car Multimedia
CPU – Central processing unit
DC – Direct Current
DFD – Data Flow Diagram
DUT – Device Under Test
DVD – Digital Video Disc
EDGE - Enhanced Data for Data Evolution
FHSS – Frequency Hoping Spread Spectrum
FM – Frequency Modulation
FOTA – Firmware Over-The Air
GAP - Generic Access Profile Specification
GATT - Generic Attribute Profile Specification

GPIB – General Purpose Interface Bus

GSM – Global System for Mobile Communication

HCI – Human Computer Interface

HFP – Hands-Free Profile

HSPA - High-Speed Pocket Access

HW – Hardware

I/O – Input / Output

I/Q - In phase and Quadrature

I2C – Inter Integrated Circuit

IC – Integrated Circuit

IEEE – Institute of Electrical & Electronics Engineers Community

IF – Intermediate Frequency

IMD – Inter Modulation Testing

IQIS – Integrated Quality Improvement System

IS – Instrumentation System

ISC – Information System Command

ISEP – Instituto Superior de Engenharia do Porto

ISM – Industrial Science Medical

Kbps – Kilobits per second

L2CAP - Logical Link Control & Adaptation Protocol Specification

LF – Low Frequency

LL - Link Layer Specification

LMP - Link Manager Protocol Specification

LTE - Long Term Evolution

MAC – Media Access Control

MIC – Microphone

MP3 – Moving Picture Experts Group Layer- 3 Audio (Audio file format / extension)

NI – National Instruments

OEM – Original Equipment Manufacturer

OFDM – Orthogonal Frequency Division Multiplexing

PAL – Phase Alternation Line

PAV – Process Alignment Validation

PC – Personal Computer

PCB – printed Circuit Board

PEP – Product Engineering Process

PHY – Physical Layer of OSI Model

PIN – Personal Identification Number

PS – Professional System

PSRR – Power Supply Ripple Rejection

QGC – Quality Gate Control

QMM – Quality Management & Methods

QMM-FA – Quality Management & Methods – Failure Analysis

QoS – Quality of Service

R&D – Research & Development

R&S – Rohde & Schwarz

R/L – Right / Left

RDS – RMS Delay Spread

RF – Radio Frequency

RMS – Root Mean Square

RS232 – Recommended Standard 232 (Computer Serial Interface)

S/N – Signal to Noise Ratio

SCM – Shift Communication Manager

SDP - Service Discovery Protocol

SINAD – Signal to Noise Ratio & Distortion Ratio

SMP – Security Manager Protocol

SMS – Short Message Service

SNR – Signal to Noise Ratio

SOP – Start of Production

SPI – Serial Peripheral Interface

SW – Software

TD-SCDMA - Time Division Synchronous Code Division Multiple Access

THD - Total Harmonic Distortion

THD+N - Total Harmonic Distortion Plus Noise

UART – Universal Asynchronous Receiver Transmitter

USB – Universal Serial Bus

VBR – Variable Bit Rate

VGA – Video Graphic Adapter

VSG – Vector Signal Generator

WCDMA – Wideband Code Division Multiple Access

WLAN – Wireless Local Area Network

WPAN – Wireless Personal Area Network

1. INTRODUCTION

The present dissertation was elaborated within the scope of the Master's in Electrical Engineering - Power Systems. The project was developed in an industrial environment, in the Department of Quality Management and Methods of Bosch Car Multimedia Portugal, S.A. More precisely, the work was integrated in the Laboratory of warranty, denominated as Failure Analysis Laboratory (QMM-FA). The QMM-FA is responsible for analyzing the products claimed by the customers to Bosch. The main activity is in 0KM/FIELD products, which are the products claimed by the automobile companies before going to the end customers. The products are in the assembly phase.

This chapter is divided into three essential parts. First part is about the introduction of the company and the department where the thesis developed. The second part is explaining the main objective of the dissertation. Finally, third part is about the structure of the thesis with small description of each following chapters.

1.1 Bosch Car Multimedia Portugal

The Bosch Group has been in Portugal since 1911. It is currently represented in Portugal in five locations: Bosch Car Multimedia Portugal, S.A., in Braga (BrgP), which belongs to the mobility solutions business area; Bosch Security Systems, S.A., in Ovar and Bosch Thermo-Technology, S.A., in Aveiro which belong to the energy and construction technology business area; Bosch House Appliances, in Lisbon that belongs to consumer goods business area and a Robert Bosch sales office in Lisbon. In Portugal, there are also research and development centers, which are in the Bosch departments in Braga and Aveiro (Figure 1). About 90% of its production is exported to more than 60 countries around the world.

Bosch Car Multimedia (CM) division is responsible for developing intelligent integration solutions for entertainment, navigation, telematics and driver assistance functions. BrgP began its activity in 1990 with the production of auto radios for the BLAUPUNKT brand and has moved into more innovative products such as information and entertainment systems and instrumentation systems for the automotive industries. Since the BrgP company is focused on the production of mobility solutions products, its main customers are linked to more than 45 brands in the automotive industry (Audi, BMW, Nissan, Jaguar, Mercedes, IVECO, Volvo, Scania, Mini, Volkswagen, Renault, Ford and Fiat, etc.,).

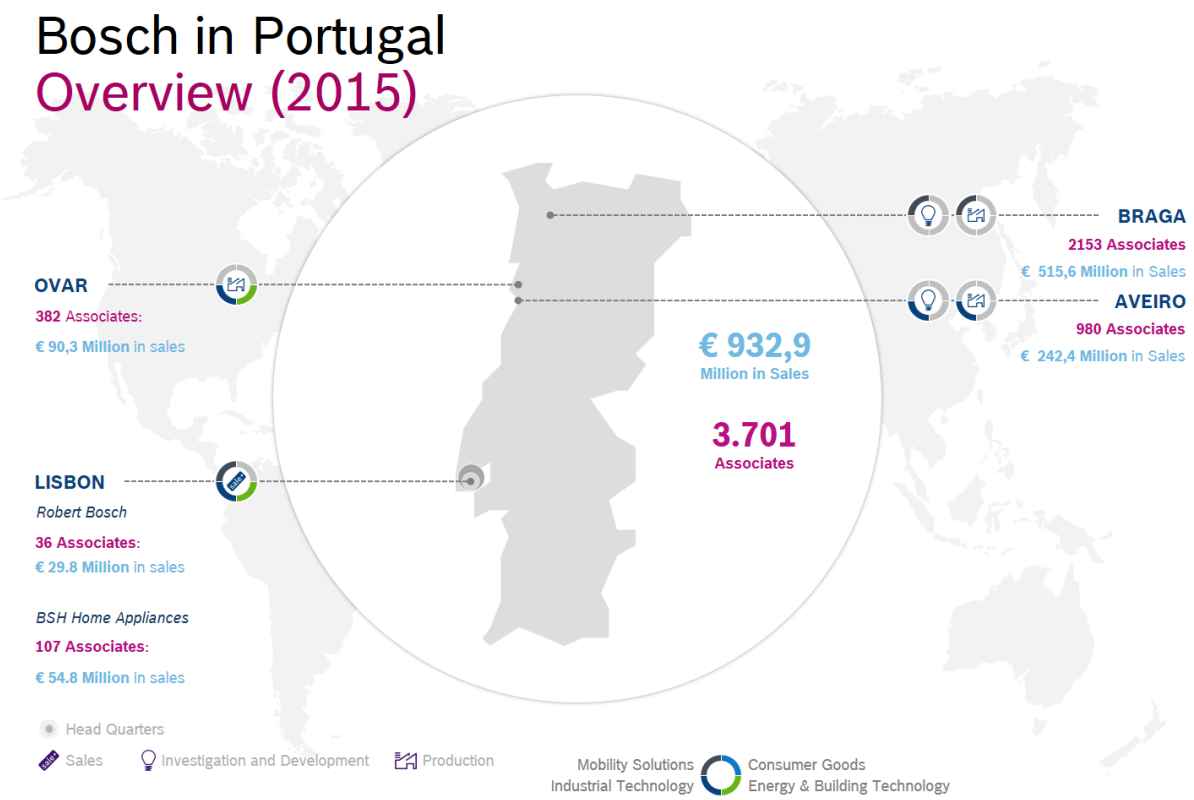


Figure 1 Bosch in Portugal

1.1.1 Department of QMM-FA

The Quality Department, Quality Management and Methods (QMM) is part of BrgP's technical area and is responsible for the overall quality of BrgP appliances, having as main functions: to deal with customer-related quality issues, to ensure quality preventive testing, approval of new products, reliability testing and equipment calibration management, quality reports and product quality testing systems. Regarding the organization of the QMM Department, it is divided into 6 sections.

QMM1 – Product quality;

QMM6 – Process & System quality;

QMM7 – Tests, reliability, product audit, calibration;

QMM9 – Customer Assistance & Project quality management;

QMM-FA – Failure analysis Laboratory;

QMM-P – Quality projects.

This project will support the QMM-FA, which is responsible for ensuring, in the electrical area, the technical analysis of products produced in BrgP. This section is part of the strategy of continuous improvement and reduction of the number of complaints inherent to the reduction of costs in warranty, essential condition for the competition in the world context. In

this section the activities of analysis, follow-up and collaboration in the process of solving nonconformities in claimed products and of participation/collaboration in teams of continuous improvements are developed.

1.2 Objectives of the Dissertation

This Master's Thesis was developed to improve the testing methodology of QMM-FA department of Bosch Car Multimedia, Portugal S.A. Currently testing is implemented by using smartphones in an end customer mode, enabling just functional tests. This project intends to answer the following research questions:

- What are the critical hurdles/ obstacles regarding the implementation of test scripts for analyzing and testing of BT modules in the car Multimedia products?
- What is the impact of the implementation of the testing script in QMM-FA laboratory?

The aim is to enable a depth analysis of BT modules according to the Bosch standards, specifications and customer specifications. As a first objective, a test plan should be developed according to the customer specifications and also to the existing testing processes in the development phase of the product and in production phase of the product. This developed test plan should be implemented as a test script in Bosch internal software to enable automating the testing procedure and reducing human interventions. A "NISSAN A IVI SCOPE_1" product (NISSAN Car Radio) will be used for validating the implemented process.

Commonly, the design of the Bluetooth modules in the car radios employs several system architectures, from conventional Intermediate Frequency (IF)-based systems with Analog Modulation (AM) to digital in-phase/quadrature (I/Q) modulator/de-modulator configurations. Currently, various forms of modules are being used. Regardless of how the Bluetooth module is tested, numerous issues must be addressed, including global regulatory requirements, Bluetooth certification, development of simple, high-yield manufacturing and test procedures, and flawless interoperability with designs from other vendors, some of which may perform at the limits of the Bluetooth specification.

In the Bosch Groups testing procedures are derived from the customer specification of each product. Customer specification is the document containing all the specifications and requirements for a particular product. This customer specification is then different for various products.

This product having a Bluetooth module, that has Bluetooth version of BT_Core_V4.2. So, here above table presents the communication protocols of BT_Core_V4.2. Developed test plan contains three different test cases. In these three test cases Device Under Test (DUT) is supplied by the three different voltage supply according to the Bosch specifications. The voltage supplies are nominal supply voltage (13.5 V), under voltage supply (10.8 V) and over voltage supply (15.6 V).

This test setup is done by using R&S Audio Analyzer – UPL, Signal Generator – SML, Programmable Power Supply – HMP, Bosch Group BLAUBOX and BLAUKIT. BLAUBOX is the standard test rack of Bosch Group to simulate the car radios to test and BLAUKIT is a standard software tool to configure and control the car radios through BLAUBOX, and by BLK Program coding the car radios simulated automatically. In this test setup, all the equipment where connected through GPIB connector with PC to configure and acquire the data remotely.

1.3 Structure of the Dissertation

- The dissertation has six main chapters. The literature review (Chapter 2) covers the analysis of existing equipment that can be used to test the BT modules and the analysis the worldwide standards and specifications of BT Protocols.
- Existing testing processes in QMM-FA are described and mapped out in Chapter 3. Critical analysis of the current situation as well as the identification of problems in the testing methodology of BT modules is described.
- Solutions to the identified problems regarding testing of BT modules are discussed and an implementation methodology are presented in Chapter 4.
- The discussion and analysis of the obtained results of the proposed testing methodology ae presented in Chapter 5.
- In Chapter 6 a reflection is made on the proposed project and the difficulties encountered throughout it. In this same Chapter, steps for improving the proposed testing methodologies in the future are presented.

2. LITERATURE REVIEW

This chapter presents the analysis & findings of the available equipment in the market to perform a standard testing procedure for BT modules. Commonly, tests of BT modules are classified into two diverse types: one is to test the BT protocol and internal properties and another one is to test the characteristics and features of the BT modules. This chapter is divided into three sub-chapters that include: the description of the Bosch internal standards & specifications for "NISSAN A IVI SCOPE_1" product (Customer Specifications), the analysis of available equipment to do functional tests of the BT protocols and the analysis of available equipment to test the specifications and feature of the BT modules.

2.1 Bosch Standards & Specifications for "NISSAN A IVI SCOPE_1" Product

In the Bosch Group, all the products are validated according to the Bosch standards & Specifications. This Bosch standards & specifications vary according to the product's customer specifications. Basically, the Bosch standards & specifications are derived from the customer specifications, also called as target specification. For this NISSAN product, Bosch Group already has a customer specification. Target specification document has a vast variety of specifications and functionalities which are illustrated in Table 1.

Table 1 Technical Functional Requirements of "NISSAN A IVI SCOPE_1" Product (For BT Modules)

S.No.	Name of the Functionality or Technical Requirements
1.	Telephone via BT
2.	External Device BT – Audio Streaming
3.	Microphone (External)
4.	Automatic Source select of user-inserted media with audio content
5.	Priority handling of audio source
6.	Entertainment Volume
7.	Mute Function
8.	Sound Pre-processing

9.	Noise Reduction
10	Audio via BT
11.	BT – Audio Specification
12.	Display of status
13.	Fault Management
14.	Telecom Function
15.	Bluetooth Configuration
16.	Bluetooth Connection ON/OFF
17.	Connecting a mobile Device
18.	Bond/De-bond Mobile Phone
19.	Discoverable mode
20.	Add a new hand-free device (Legacy Pairing)
21.	Add a new hand-free device (Secure Simple Pairing)
22.	Replace a phone
23.	Bluetooth PIN
24.	Name of the BT device
25.	Operation Modes
26.	Hands Free Profile (HFP)
27.	Telephone Function
28.	Audio Channel
29.	Short Message Service (SMS)
30.	Phone Book
31.	Telematics Function
32.	Interoperability
33.	Activation of BT Connection

33.	BT Player

These functional requirements are validated in the development phase of each product through a set of testing plans, called Product Release & Inspection Plan or FEP. This Release Test Plan is described in the Chapter 3, section 3.3.

2.2 Bluetooth Technology

Bluetooth is a wireless technology to transmit data over short range distances, with a maximum of 100m. Initially, this standard was developed specially for industrial applications to eliminate wired communications e.g. to avoid the use of RS-232 data cables. Bluetooth technology works in Industrial, Science and Medical (ISM), short range radio frequency band with the operating frequency of 2.402 to 2.480 GHz.

Now a days Bluetooth is implemented in various different product such as, mobile phones, printers, modems and headset, etc. Bluetooth is most commonly used with phones and hand-held computing devices, either using a Bluetooth headset or transferring files from phones/PDAs to computers. Bluetooth also simplifies the discovery and setup of services as devices advertise all services they provide. This makes the service much more accessible, without the need to worry about network addresses, permissions and all the other considerations that go with typical networks.

Bluetooth uses Frequency-hoping Spread Spectrum_(FHSS) technique, which involves splitting the frequency band of 2.402 – 2.450 GHz. Data to be transmitted is divided into packets, and each packet transmitted using one of the 79 designated Bluetooth channels. Each channel has a bandwidth of 1 MHz and it performs 800 hops per second, with Adaptive Frequency Hoping (AFH) enabled. Thus, by switching channels as often as 1600 times a second, the Bluetooth standard can avoid interference with other radio signals.

Bluetooth technology uses a Master-Slave approach to communicate and connect the devices. One master can communicate/pair with seven different slave devices simultaneously. BT Versions are:

1. BT Core Version1.0 & Version1.0B
2. BT Core Version1.1
3. BT Core Version1.2
4. BT Core Version2.0 + EDR
5. BT Core Version2.1 + EDR

6. BT Core Version3.0 + HS
7. BT Core Version4.0 + LE
8. BT Core Version4.1
9. BT Core Version4.2
10. BT Core Version5 (Latest Version)

The Bluetooth Standard is managed by the Bluetooth Special Interest Group (BT_SIG), a worldwide group responsible for all the Bluetooth Protocol's Standards and specifications as well as for the licensing of the Bluetooth Technologies and trademarks to manufacturers. The BT_SIG is a non-profit organization and does not make, manufacture or sell Bluetooth enabled products. Table 2 shows the BT specifications for Core_V4.0+L.E. / 4.1 / 4.2.

Table 2 Test Specifications of BT by BT_SIG (Bluetooth_SIG, 2017)

S.No.	Test Specifications	Abbreviation of Test Specifications
1	IEEE 802.11 MAC/PHY	Media Access Control/Physical Layer of OSI Model Specification by IEEE
2	IEEE 802.11 PAL	Phase Alteration Line Specification IEEE
3	A2MP	AMP Manager Protocol Specification
4	GATT	Generic Attribute Profile Specification
5	BB	Base Band Specification
6	GAP	Generic Access Profile Specification
7	HCI	Host Controller Interface Specification
8	L2CAP	Logical Link Control & Adaptation Protocol Specification
9	LL	Link Layer Specification
10	LMP	Link Manager Protocol Specification
11	RF	Radio Frequency Specification
12	RF PHY	RF Physical Layer
13	SDP	Service Discovery Protocol
14	SMP	Security Manager Protocol

Related requirements are specified as the IEEE 802.15 family. IEEE 802.15 is a global standard for Wireless Personal Area Network. This standard is from the Institute of Electrical & Electronics Engineers. IEEE 802.15 standard is summarized in the following table,

Table 3 IEEE 802.15 Standards for Wireless Personal Area Networks

S.No.	Name of the Standard	Standard Specification
1.	IEEE 802.15.1 WPAN/Bluetooth	Mainly established to ensure the standards for Bluetooth technology. It's for PHY & MAC specification for wireless communication networks in personal operating space.
2.	IEEE 802.15.2 Coexistence	This standard specifies the coexistence of WPAN with other wireless devices in all frequency bands (IEEEStandards, 2017).
3.	IEEE 802.15.3 High Rate WPAN	This standard has four subdivided sub standards. Mainly this standard is for high rate (11 to 55 Mbit/s), Higher Speed, High Speed Internet Access, Streaming content download, real time streaming and wireless data bus.
4.	IEEE 802.15.4 Low Rate WPAN	Basically, this standard deal in low rate with very long battery life & low complexity. It defines the physical layer & data link layers of OSI model. This standard providing high precision ranging & location capabilities. It also has number of subdivisions with lots of amendments.
5.	IEEE 802.15.5 Mesh Networking	This standard is for WPAN networks to offer interoperable, stable and scalable wireless mesh networking. It has two subdivisions with high-rate WPAN mesh networks & low-rate mesh networks.

6.	IEEE 802.15.6 Body Area Networks	This standard focus on low power & short-range wireless standards.
7.	IEEE 802.15.7 Visible Light Communication	Standard is framed for free-space optical communication using visible light.
8.	IEEE 802.15.8 Peer Away Communications	This standard is mainly for networks that operating bands below 11 GHz.
9.	IEEE 802.15.9 Key Management Protocol	This protocol is based on information elements as a transport method for Key Management Protocol datagrams (IEEEStandard, 2017).

2.2.1 IEEE 802.11 Working Group Standards for Wireless Technology Communications

In 1997, the Institute of Electrical and Electronics Engineers (IEEE) created the first standard for wireless communication technology. It is named as 802.11. This group framed to develop and implement standards for wireless communication technologies. It is supports a maximum network bandwidth of 2 MBPS - too slow for most applications. Important standards for BT protocols are presented in the Table 4.

Table 4 IEEE Standards and its Description

S.No.	Name of the Standard	Description
1	802.11A, G, H, J	OFDM for WLAN
2	802.11N	High Throughput
3	802.11AC	Very High Throughput
4	802.11E	Supports for QoS & Direct Link Support
5	802.11R	Support for Handoff
6	802.11B	High-Speed PHY Extension

2.3 Test Equipment for the BT Protocols

The following equipment is available in the market to test the BT protocols and its internal properties.

1. **InterLab Test Solution BT(R) RF (7Layers, 2017)** - This equipment provides RF test coverage for all the versions of BT. This test setup has two functions, one is to use in production line and another one is to use in development of the new BT products. Figure 2 shows the test setup using the equipment.

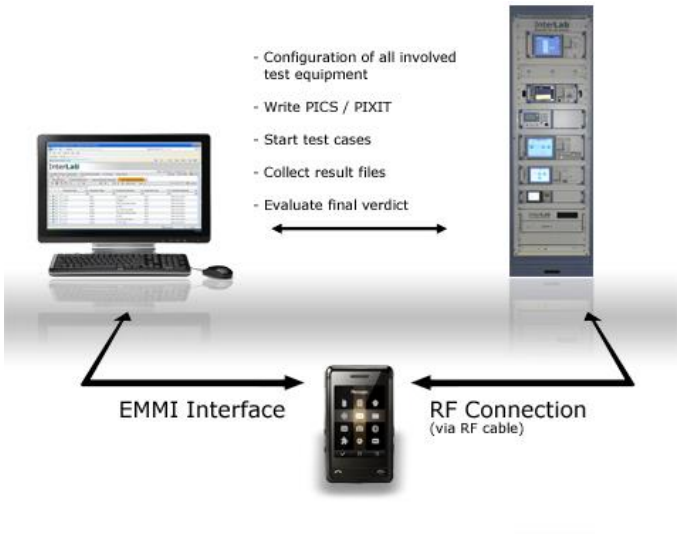


Figure 2 BT RF Test Solutions, (7Layers, 2017)

2. **Universal Wireless Test Set (Anritsu, 2017)** - This test set is designed to implement production lines test of smartphones, tables and wireless protocol communication modules. It is used to test the WLAN, BT and other wireless connectivity.

Figure 3 Universal Wireless Test Set, (Anritsu, 2017)

The full list of supported standard is: LTE/LTE-Advanced, W-CDMA/HSPA, TD-SCDMA, GSM/EDGE, WLAN 802.11b/g/a/n/p/ac, BT up to v5.0, ZigBee, Z-Wave and FM/RDS. The same equipment can support 4 different modules, enabling the simultaneous test of 4 assorted products. The capability of the tests depends on the license installed in the equipment. It is controlled by the external PC. Figure 3 shows the test equipment.

3. **Ellisys BT Explorer Protocol Analysis System** - This protocol analyzer is specially used to test the wireless communication protocols. Among others, it supports BR/EDR, LE, Wi-Fi. This equipment has a free maintenance and lifetime software updates. The test equipment is showed in the Figure 4.

Figure 4 Ellisys BT Explorer All-in-One BT® Protocol Analysis System, (Ellisys, 2017)

4. **LTE RF Integration Test System, Hyper Taiwan Technology** – This test equipment mainly used to test and certify LTE products. It has six different configurable test architectures to analyze and speed up the testing process.

Figure 5 LTE RF Integration Test System, (HyperTaiwanTechnology, 2017)

Each testing architecture contains a PC server with self-software to control the testing setup. The system has flexible configurations to perform a different type of tests. The software has a user-friendly windows interface with different LTE products. Specially this contains the integrated LTE Tester, Signal analyzer, VSG and ASG. Figure 5 shows the test system.

5. **E6640A EXM Wireless Test Set, Key Sight Technologies** – Testing bandwidth is up to 6 GHz. It supports multi-protestation with two full-duplex, two half-duplexes or four duplex ports per transmitter/receiver channels. The supported protocols are: LTE, GSM, W-CDMA, RF Measurements – TX, RX Tests. This test setup can test up to 32 DUTs simultaneously with multiple measurements. Figure 6 shows the EXM test set.

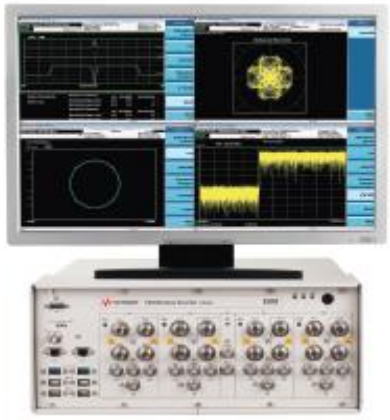


Figure 6 EXM Wireless Test Set E6640A, (KeySightTechnologies, 2017)

6. **High-Performance RF and Functional Test of Automotive Infotainment and e-call modules, National Instruments** - This instrument is mainly used to test the RF characteristics of wireless communication protocols with multi signal generators.

Figure 7 High-Performance RF and Functional Test of Automotive Infotainment and e-call modules, (NationalInstruments, 2017)

Four DUTs can be connected with four ports, each including independent testing arrangements. It is more flexible for the production lines in order to perform the fixed tests repeatedly. Figure 7 illustrates this equipment.

7. **BT Smart Protocol Analyzer, Perytons -** This protocol analyzer is a smart application software to simulate and perform RF tests. It is used in development, integration, installation, monitoring, and troubleshooting processes.

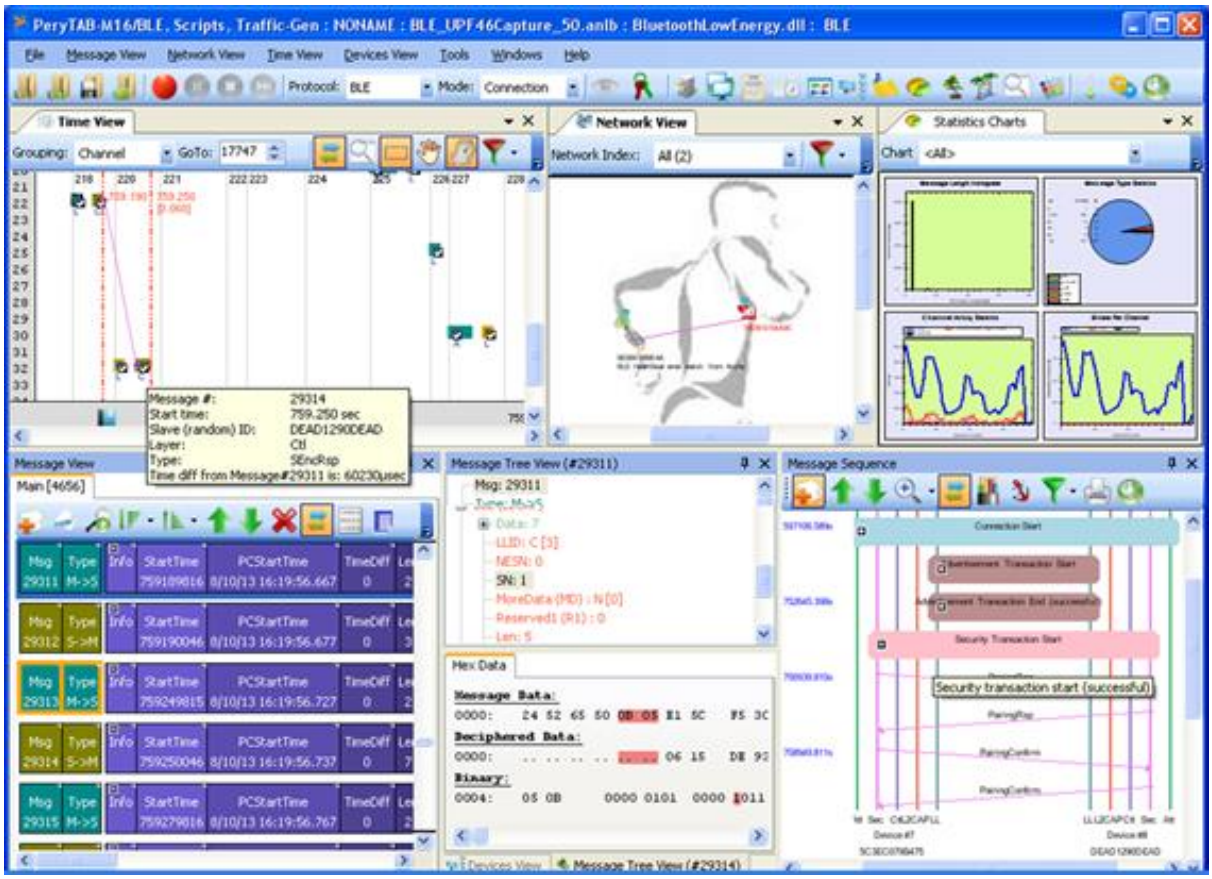


Figure 8 Application Software of BT Smart Protocol Analyzer, (Perytons, 2017)

It is a front-end application, used to test the wireless communication protocols. It is based on a single sophisticated core software structure built of different views and options. It allows easy upgrading from basic to more sophisticated models (Perytons, 2017). Figure 8 shows the screen shot of the application software to test the wireless communication products.

8. **CMW500 - Wideband Radio Communication Tester, Rohde & Schwarz -** It supports different wireless standards and broadcast technologies, including LTE, WLAN & other wireless technologies. This equipment is mainly used in development, verification and production of the wireless communication products to

perform RF tests and protocol tests. It allows testing 6 different DUT's at the same time. Figure 9 shows the test equipment**.**

Figure 9 CMW500 Wideband Radio Communication Tester, (Rohde&Schwarz, 2017)

Table 5 shows the comparative description of the test equipment of the BT protocols.

Table 5 Comparison of Available Equipment to Test BT Protocols & Internal Properties

Features & Equipment	Applicable BT Version	Type of the Application	Testing Frequency	External requirements	No. of Testing DUTs in the same time	Applicable testing standards	About License
1.	N/A for BT_V5	RF Test Applications for Production line & development of new products.	2.4 GHz	Need of Computer & External Equipment if needed	1 DUT	BT_BR/EDR, Low Energy by BT_SIG	One time license, with application software
2.	Applicable until BT_V	LTE/LTE-Advanced, W-CDMA, WLAN,	10 MHz to 6 GHz	External Monitor	4 DUTs	Bluetooth by BT_SIG, FM, LTE,	Different required licenses depends

	5	Bluetooth – TX & RX Tests with internal Audio Analyzer & Signal Generator				W-CDMA, IEEE 802.11 n	on the application with different software application also validity is limited
3.	Applicable until BT_V5	BT RF Tests, WIFI spectrum Analysis, Protocol Analyzer	2.4 GHz	Need of Computer & External Equipment if needed	1 DUT	BT_BR/EDR, Low Energy, WIFI IEEE 802.11 a/b/g/n/	Life-Time License
4.	NA for BT_V5	RF Conformance Test, Profile Conformance Test, Profile Interoperability Test	2.4 GHz	Need of Computer & External Equipment if needed	1 DUT	BT_BR/EDR, Low Energy by BT_SIG	Limited Validity
5.	NA for BT_V5	LTE, GSM, W-CDMA, RF Measurements – Tx, Rx Tests	Up to 6 GHz	Need of Computer & External Equipment if needed	up to 32 DUTs	BT_BR/EDR, Low Energy by BT_SIG, IEEE 802.11 a/b/g/n/ac/af/ah, WLAN Tests	Requirement of different software licenses for different measurements & Limited Validity

6.	Applicable until BT_V5	RF Measurements, LTE, GPS, FM/RDS, TD-SCDMA/CDMA/EDGE	65 MHz to 6 GHz	Need of Computer & External Equipment if needed	up to 16 DUTs	WIFI 802.11 a/b/g/n/ac, BT & BT LE,	Life-Time Validity depends on the Application
7.	Applicable until BT_V5	Protocol Analyzer especially for R&D Cycle Tests	2.4 GHz	Need of Computer	1 DUT	BT_BR/EDR, Low Energy by BT_SIG	Application Software – Life-Time Validity
8.	Applicable until BT_V5	RF Tests, Protocol Tests, Production Applications, Development Tests, Application Tests, WCDMA, WLAN, FM Stereo, EDGE, Mobile Cellular Tests, Audio Testing of BT	70 MHz to 6 GHz	No need of External equipment	6 DUTs	BT_BR/EDR, Low Energy by BT_SIG, IEEE 802.11 a/b/g/n/ac/af/ah, WLAN Tests	Requirement of different software licenses for different measurements

2.4 Test Equipment for the Audio Signal of BT Modules

The main functionality of the Bluetooth module in the Bosch Car Radio is audio streaming via Bluetooth with smart phones. This thesis is mainly devoted to test and analyze the features of audio streaming via Bluetooth and other characteristic measurement of the Bluetooth audio signal. For that, a list of equipment was identified:

1. FX100 Analog & Digital Audio Analyzer, NTi Audio Systems
2. U8903B Performance Audio Analyzer, Key Sight Technologies
3. Audio Analyzer – APx52x Series, Audio Precision
4. Audio Test & Measurements, Prism Sound
5. MT8855A BT Audio Test Set, Anritsu
6. SoundCheck – Bluetooth Audio Test Setup, Listen
7. Rohde & Schwarz Audio Analyzer – UPL DC…110 KHz

2.4.1 FX100 Analog & Digital Audio Analyzer, NTi Audio Systems

Figure 10 shows the FX100 Analog & Digital Audio Analyzer from NTi which is appropriate one to be used it in quality control of audio measurements for Manufacturing test lines and also for R&D test applications. It includes I/O channels for simultaneous measurements. The residual noise of the analyzer is -104 dB and it operates in the frequency range of 5 Hz to 80 KHz for detailed DC & Audio frequency analysis. It acquires all the measurements & functionalities simultaneously.

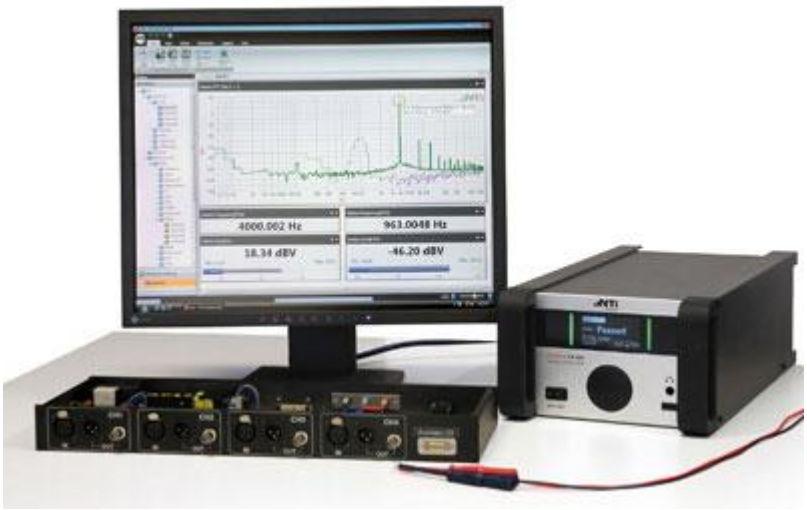


Figure 10 FX100 Analog & Digital Audio Analyzer, (NTiAudioSystems, 2017)

It has a FX Control Suite – PC based application software provides a wide range of control over the measurements and configurations. Applicable programming languages are .NET Programming, C#, Visual Basics. It is mainly used in the R&D cycle measurements and production tests with variable frequency, time, amplitude & treble sweeps.

2.4.2 U8903B Performance Audio Analyzer, KeySight Technologies

Figure 11 shows the U8903B Performance Audio Analyzer. It's mainly used to test low distortion devices – with residual distortion range of lesser than -110 dB. Possible characteristic tests are:

- Signal to Noise Ratio measurements
- SINAD
- IMD
- DFD
- THD Ratio
- THD+N level
- Crosstalk

Operating frequency of the analyzer is 10 Hz to 1.5 MHz from DC. It includes 8 I/O channels for simultaneous measurements for different DUTs. It is possible to configure the required filters for different measurements. Speech & Audio quality measurements are possible.

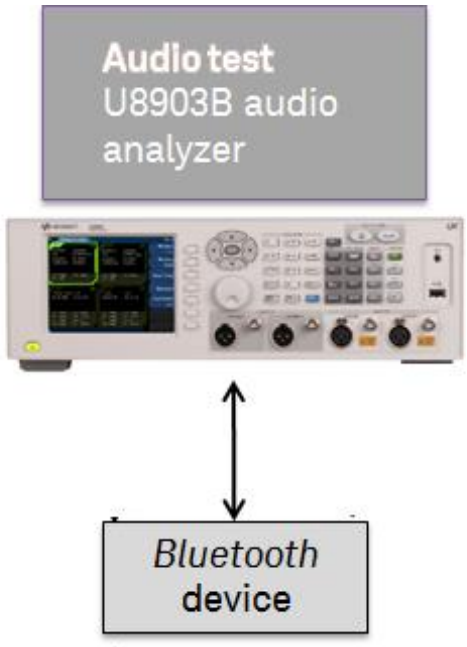


Figure 11 U8903B - Performance Audio Analyzer (KeySightTechnologies, 2017)

2.4.3 Audio Analyzer – APx52x Series, Audio Precision

Figure 12 shows the Audio Analyzer – Apx52x series. It supports signals within the range of 90 KHz to 1 MHz with the -108 dB residual distortion range.

Figure 12 Audio Analyzer - APx52x Series, (AudioPrecision, 2017)

It includes up to 4 I/O channels for simultaneous measurements. SNR Measurement with 129 dB (1 KHz, BW, un weighted, 256x oversampling, 4th order Modulator) is possible and THD+N Measurements up to -130 Db.

2.4.4 D-Scope Series III Analog & Digital Audio Analyzers, PrismSound

Figure 13 shows the front side & backside views of the equipment. It is an industrial audio test – measurement system with a PC based software application. Signal analyzer has two I/O channels for both analog and digital applications and reads RMS amplitude, frequency and phase of the incoming channel.

Figure 13 Analog and Digital Audio Analyzer- DScope Series III (PrismSound, 2017)

It implements high-pass, low-pass and band-pass filters, weighting functions and different meter response. It is used for the specialized measurements they are, PSRR, gain measurements, intermodulation, noise measurements and cross-talk measurements. Both digital carrier and digital data can be analyzed and controlled.

2.4.5 BT Audio Test Set – MT8855A, Anritsu

Figure 14 shows the Audio Test Set. This audio test set specially designed for high quality audio measurements in all kinds of Bluetooth enabled devices. It is used to test Bluetooth Headsets, Mobile Phones, Digital Music Players, integrated and accessory car kits and desktop speakers. This equipment is authorized by BT_SIG to test Bluetooth enabled devices according to the specifications and standards provided by BT_SIG.

Figure 14 BT Audio Test Set - MT8855A (Anritsu, 2017)

It includes a software application called Blue-Audio, to interfaced with PC to provide wide range of testing applications. It contains the Special Audio Test mode that performs rapid and repetitive production tests with configurable test plans with archived report generation. It is very useful for R&D test measurements and productive validation tests.

2.4.6 SoundCheck – Bluetooth Audio Test Setup, Listen

Figure 15 shows the Test Setup. This test setup includes the software module called as Sound-Check Plus (1102) and hardware modules are AmpConnect ISC, SCM Microphone(reference), BTC-4148 Bluetooth Interface.

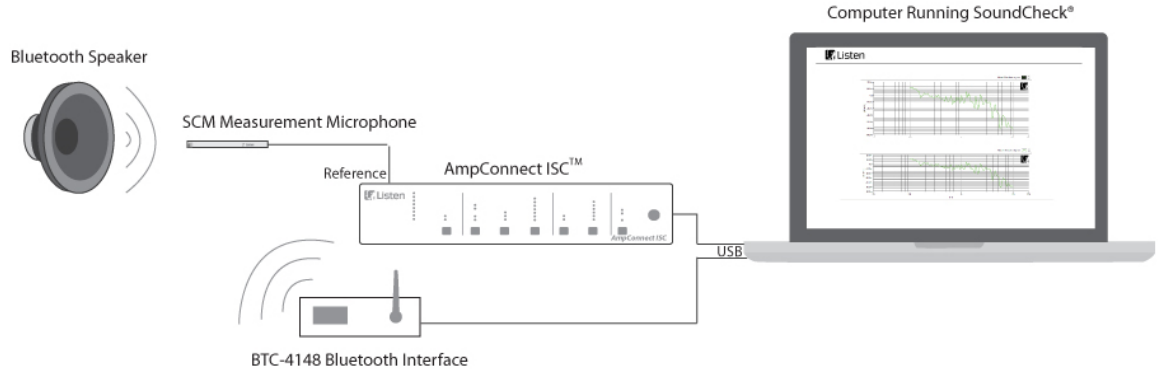


Figure 15 Sound-Check Bluetooth Audio Test Setup (Listen, 2017)

This is an ideal tool to test wireless devices as it contains different types of algorithms to perform all the variety of tests in all the different wireless products. It could be applicable to RF Testing of Bluetooth Modules, Protocol Testing up to Bluetooth Version_5.

2.4.7 Audio Analyzer – UPL DC...110KHz, Rohde & Schwarz

The Rohde and Schwarz Audio Analyzer – UPL DC...110KHz is presented in Figure 16. By using UPL analyzer, it is possible to measure both Analog and Digital. It has excellent specifications, Analog Sine wave generation with harmonics of -120 dB, spectrum displays with a noise floor below -140 dB and -160 dB for digital interferences. It has a special feature of controlling, configuring and acquiring through GPIB connector with special GPIB commands – universal sequence controller. Figure 16 shows the block diagram of the UPL audio analyzer.

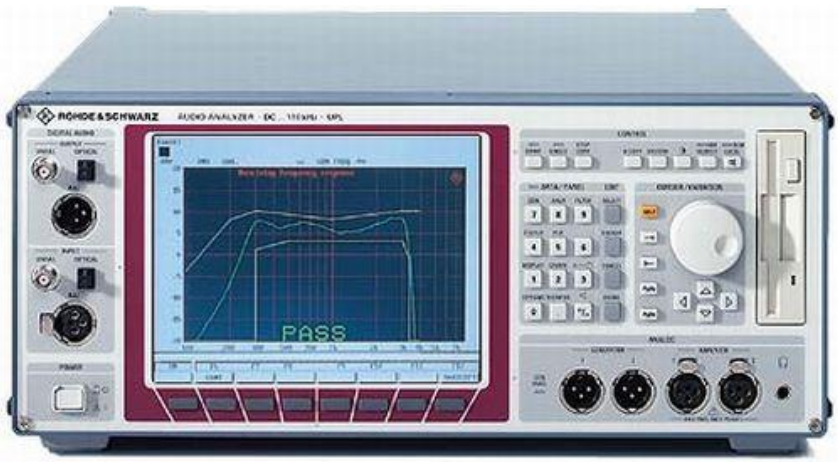


Figure 16 Audio Analyzer - UPL DC 110 KHz, (Rohde&Schwarz, 2017)

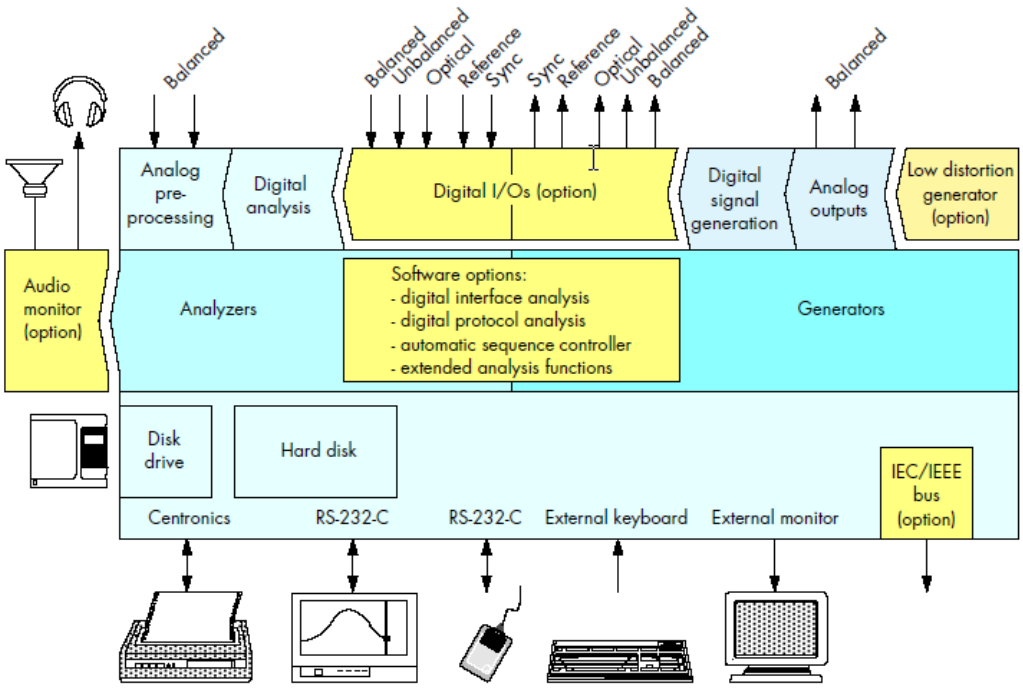


Figure 17 Block Diagram of UPL (Rohde&Schwarz, 2017)

Table 6 shows the comparison of the different audio analyzers. From this comparison Rohde & Schwarz Audio Analyzer – UPL is the best one to analyze the Bluetooth Audio as it has the best control and acquiring of data through remotely via GPIB connector. Special GPIB commands are specially designed to configure all the available functionalities with effective acquiring of particular required data.

Table 6 Comparison of Available Audio Analyzers

Equipment	1	2	3	4	5	6	7
Channels	14 I/O's	2 Analog Generator / Analyzer Channels	2	Digital and Analog I/O: 2	2	2	Analog, Digital and Combined Measurements
Frequency	Up to 80 KHz	10 Hz to 1.5 MHz	0.1 Hz to 80.1 KHz	<1Hz to >90KHZ	20 Hz to 20 KHz	44.1 KHz	10Hz to 110KHz

Functions	Frequency Response, THD+N and Distortion	Signal-to-Noise Ratio, SINAD, IMD, DFD, THD ratio, THD+ level and Cross talk Specially designed to measure Bluetooth Audio	Frequency Response, THD+N and Distortion	Amplitude, Phase, Balance, IMD (SMPTE, CCIR), THD+N, Cross-Talk, SNR and Weighted Noise, Power, Frequency, Gain, Frequency Response and THD+N vs Frequency	Frequency Response, Level Measurements, THD+N, FFT analysis, THD, SINAD, Stereo Phase, Stereo Separation,	Frequency Response, Sensitivity, Phase, Polarity, Signal to Noise Ratio, Distortion, Simulated free field measurements, Directional characteristics and Impulse Response	Level or S/N, Selective function, SINAD or THD+N, THD, Modulation distortion, inter modulation, polarity test, crosstalk and waveform functions
Residual Noise	-104 dB	-110 dB	-105 dB	<–115dBu (<1.4µV)	-104 dB	-114 dB	< –110 dB, typ. –115 dB
Specified Application	R&D labs, broadcast stations, service centers, or production facilities	R&D application & Production Testing	R&D application & Production Testing	R&D application & Production Testing	R&D, Test Validation Process with manual test mode	R&D, Production Line & Competitive Measurements	R&D, Production Line, Digital Audio Protocol Test,

Application Software	PC based application program supports all .NET languages	NA	NA	PC Based Software Application	PC-installed user interface: BlueAudio	SoundCheck Plus (1102) PC based	No PC based Application. It has GPIB port to operate & configure remotely via GPIB connector

2.5 Bosch Analyzing Tools – BLAUBOX & BLAUKIT

BLAUBOX & BLAUKIT are the standard analyzing tools in Bosch Group. BLAUKIT is the application software to run the BLK program codes.

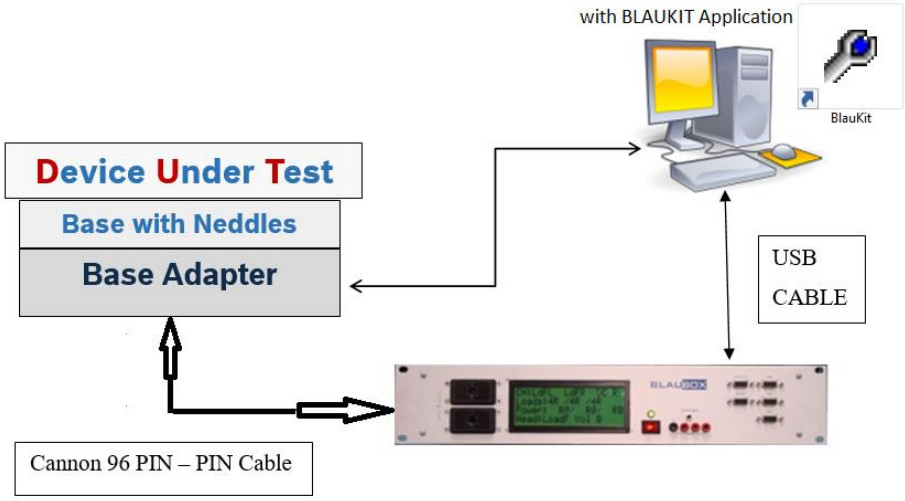


Figure 18 Test Setup Using BLAUBOX & BLAUKIT

BLAUBOX is a hardware rack with internal firmware & hardware modules to communicate and command the DUT. BLAUKIT & BLAUBOX are not dependent, it could work with all kinds of platforms not only in this combination. Figure 18 shows the test setup with DUT.

2.5.1 BLAUKIT

BLAUKIT has a Visual Basic interface working over an ActiveX Engine where all the basic functions are implemented. BLAUKIT can work in four main ways:

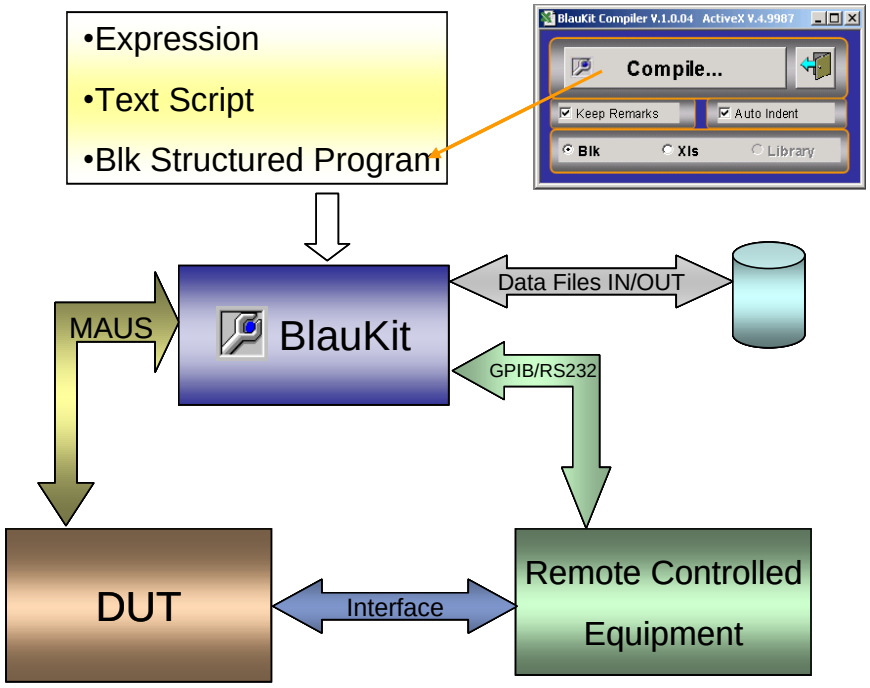


Figure 19 BLAUKIT Flowchart

- By executing individual expressions entered using a command line interface;
- By executing a sequence of expressions in a text file (script).
- By running a BLAUKIT structured program, compiled as a BLK file. BLAUKIT executes this program with a different interface than script files.
- After executing the blk. scripts, the results are displayed and it is possible to store the results as an excel document. Figure 19 shows the interaction flowchart of BLAUKIT.

2.5.2 BLAUBOX

BLAUBOX is a 19-inch box hardware interface to test electronic devices. Typically, these devices are oriented to a car radios, but it can be used with any other device that needs power supply control, input signals and measurement of outputs.

Figure 20 Front Panel of BLAUBOX

Figure 21 Top View of BLAUBOX

It supports some standard bus protocols: MAUX, CAN, SPI, I2C, UARTs. Figure 21 shows the top view of the BLAUBOX with inside PCB connections.

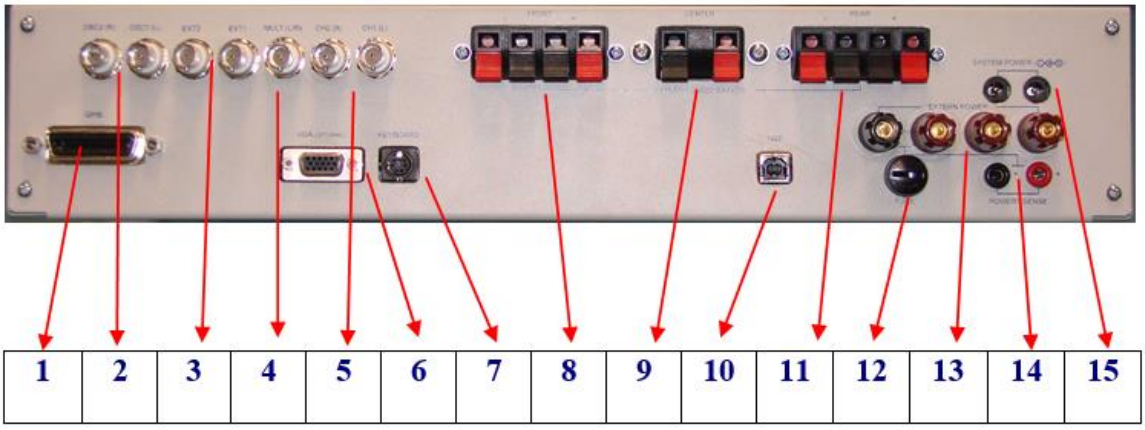


Figure 22 Rear Panel of BLAUBOX

The front panel of BLAUBOX - includes 2 Cannon 96 connectors in parallel. The reason for this is that the DUT is connected to one Cannon 96 while all the signals are still available in the other Cannon so that external devices can also be connected making any possible configuration test. This is showed in Figure 20. The rear panel of the BLAUBOX is illustrated in the Figure 22 and the port's description is explained in Table 7.

Table 7 BLAUBOX Rear Panel Port's Description

Item	Description	Remark
1	GPIB connector	
2	Single end output connectors (R / L)	Typically oscilloscope output connectors.
3	External input signals Ext2 / Ext1	Input sources available to all Aux

4	Multi-meter output connector	
5	Channel output CH2 / CH1.	Typically audio analyzer output
6	VGA connector (optional)	Only for development purposes.
7	Keyboard connector	
8	Front loudspeakers connector	
9	Center loudspeakers connector	
10	USB connector	
11	Rear loudspeakers connector	
12	System power fuse	System power
13	Sense for power for DUT	
14	Sense for power for DUT (Power 1)	
15	System power	10…17V DC. Can also be used to power the device under test, depending

The BLAUBOX equipment has the following features.

- Three Power circuit with consumption monitoring (2 ranges), one with sense.
- Differential input channel multiplexing (2x 8:1).
- Differential output multiplexing (12x 4:1 single + 4x 4:1 differential)
- Power supply insulation and programmable gain amplifier.
- Audio analyzer, multi-meter and oscilloscope outputs all independent.
- Independent audio circuit for headphones and Digital volume control.
- 7 output bit plus 7 input bit in two 9 pin plugs with ground and power.
- Front, Rear and Centre independent 2Ω/4Ω/6Ω/8Ω/∞Ω load switching.
- Front, Rear and Centre independent loads/loudspeakers switching.
- Temperature control.
- GPIB and RS232 interfaces with PC.
- 4x20 character display.
- UART, I²C, SPI, CAN, LIN.
- ADC and MAUS interface.
- VGA, PC keyboard, Floppy and Hard Disk Drive available for development versions

3. BOSCH TESTING PROCEDURE

This chapter elaborates the manufactured Car Multimedia products in Braga Plant, Product Engineering Process in Bosch and the validation process in phases of PEP and Testing process in the department of QMM-FA as a claimed product for the Bluetooth modules. These tests are called as existing testing procedure in Bosch and also in QMM-FA. The critical review of the existing testing procedure is also explained briefly.

3.1 About CM Products in BrgP

BrgP specializes in the production and development of various devices such as car radios, navigation systems, instrumentation systems that are grouped into three Business Units (BU). Most of the products have a BT module. In 2015, about 7.7 million devices were produced distributed among the different Bus. Figure 23 illustrates the three different groups of Bosch Car Multimedia products and it is explained in the following.

Figure 23 Products according to BU

- Automotive Navigation & Infotainment Systems (AI): responsible for the development of intelligent solutions that integrate functions of entertainment, navigation, telematics and assistance in driving;
- Instrumentation System (IS): responsible for the development of displays and control systems, as well as innovative HMI solutions for driving equipment;

- Professional System (PS): responsible for the development of equipment and systems for professional vehicles: audio, video, navigation systems and connectivity solutions for trucks and buses.

CM products BT modules are used to pair with the customer's smartphones in order to provide a wireless communication between the product and mobile phones. For audio screaming, call to contacts, etc. The following list of products are having a Bluetooth module in it.

Table 8 List Latest Products and it's BT Versions

S.No.	Name of the Project	BT Version Used	BT IC Specification
1.	JLR NGI	Bluetooth v4.0- Low Energy (BLE)	Intel PBA5001 - WP-A HMC
2.	BMW, I Kombi	Bluetooth Version 4.2 (Class2)	Marvell 88W8887A
3.	KTM LC8	Bluetooth Version 4.2 (Class2)	Marvell 88W8887A
4.	GM MY16	BLUETOOTH™ Version 3.0 + HS (High Speed)	CSR8311A08
5.	GM MY17	BLUETOOTH™ Version 3.0 + HS (High Speed)	CSR8311A08
6.	NISSAN LCN 1	BT 3.0+HS	CSR8311A08
7.	NISSAN LCN 2	BT 3.0+HS	CSR8311A08
8.	NISSAN LCN2KAI	BT 3.0+HS	CSR8311A08
9.	NISSAN A-IVI SCOPE 1	Bluetooth Version 4.2 (Class2)	Marvell 88W8887A
10.	PSA RCC	BLUETOOTH Version 3.0 + HS (High Speed)	CSR8311A08
11.	DIMELER CTP	Bluetooth Version 4.2 (Class2)	Marvell 88W8887A

3.2 Testing Process in Bosch's Product Engineering Process

Product Engineering Process(PEP) is a product development process in the Bosch Group. PEP process is showed in Figure 24. The phases of the project are called as Quality Gates

Control. This process has six Quality Gate Control (QGC) from QGC0 to QGC5. The first phase QGC0 is about the product concept with acceptance procedure. It is about initialization of the project and planning the project path with Kick-off.

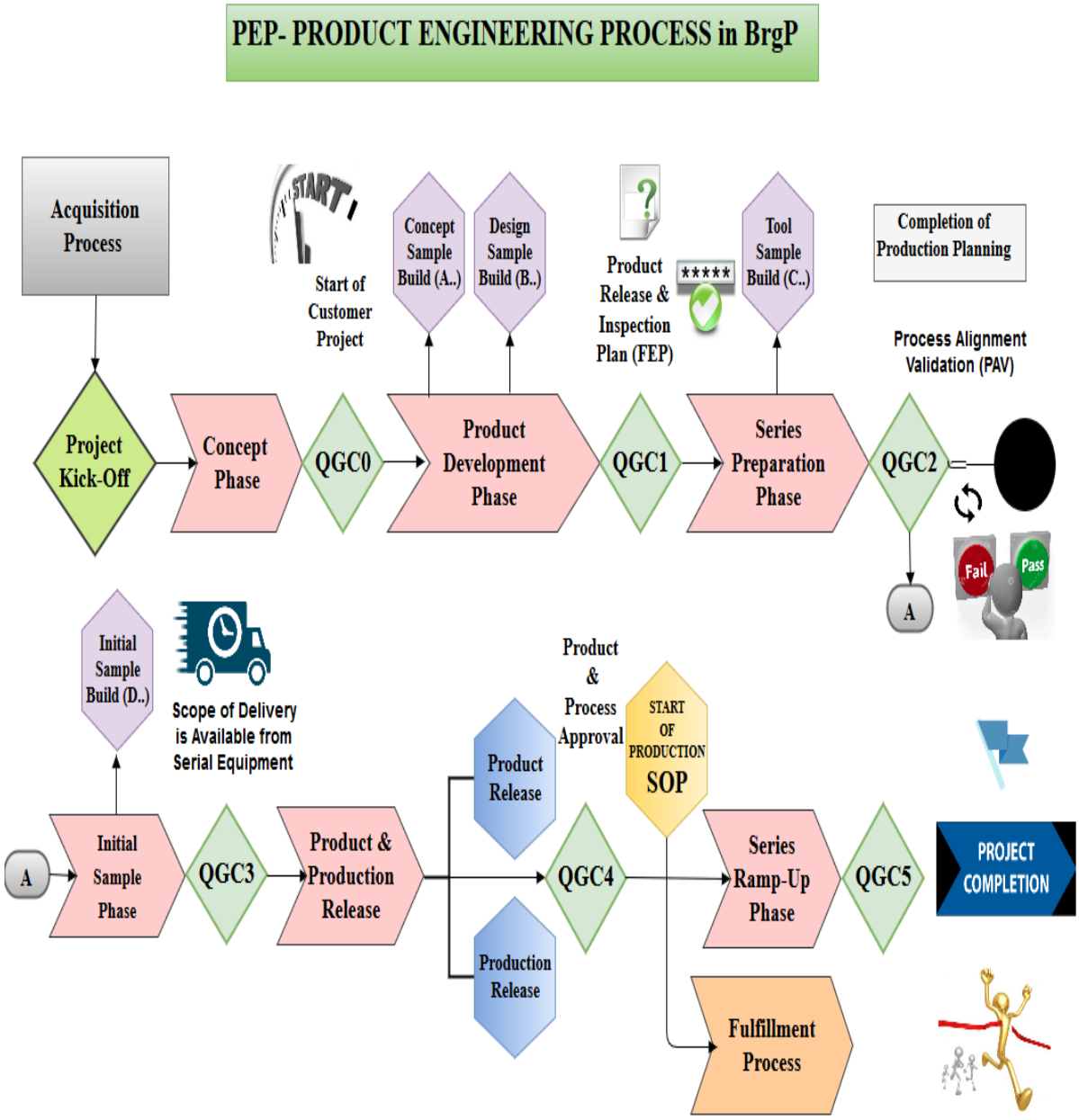


Figure 24 Bosch PEP Process

Second phase (QGC1) is product development with completing of product design. In this phase production of A & B Samples were takes place. In this stage products may still not have its complete functionalities and properties implemented. End of this phase, FEP validation is takes place. FEP – Product Release & Inspection Plan, which is the validation process in the development phase of the product. FEP is framed according to the customer requirements and specifications.

Third phase (QGC2) is series preparation with 1st off tools which means all the required tools from the supplier for products are available in the plant. In this phase C-Samples are manufactured. These samples have almost all the functionalities of the final product but were still not yet accepted by the customers and approval is pending. In the end of this phase production planning is completed and the Process Alignment Validation_(PAV) testing plan is installed in the production line to start the product.

In the fourth phase, Product development process – 2, everything is ready for mass production and D-Samples are produced are ready to be sent to the customer's approval. In this process, D-Samples gets modified according to the customers' needs and it is repeated until to satisfy the customers' requirements and expectation. In the fifth phase of the PEP is Product Process Implementation, D-Samples are finalized. At the end of this process Start of Production takes place with mass production.

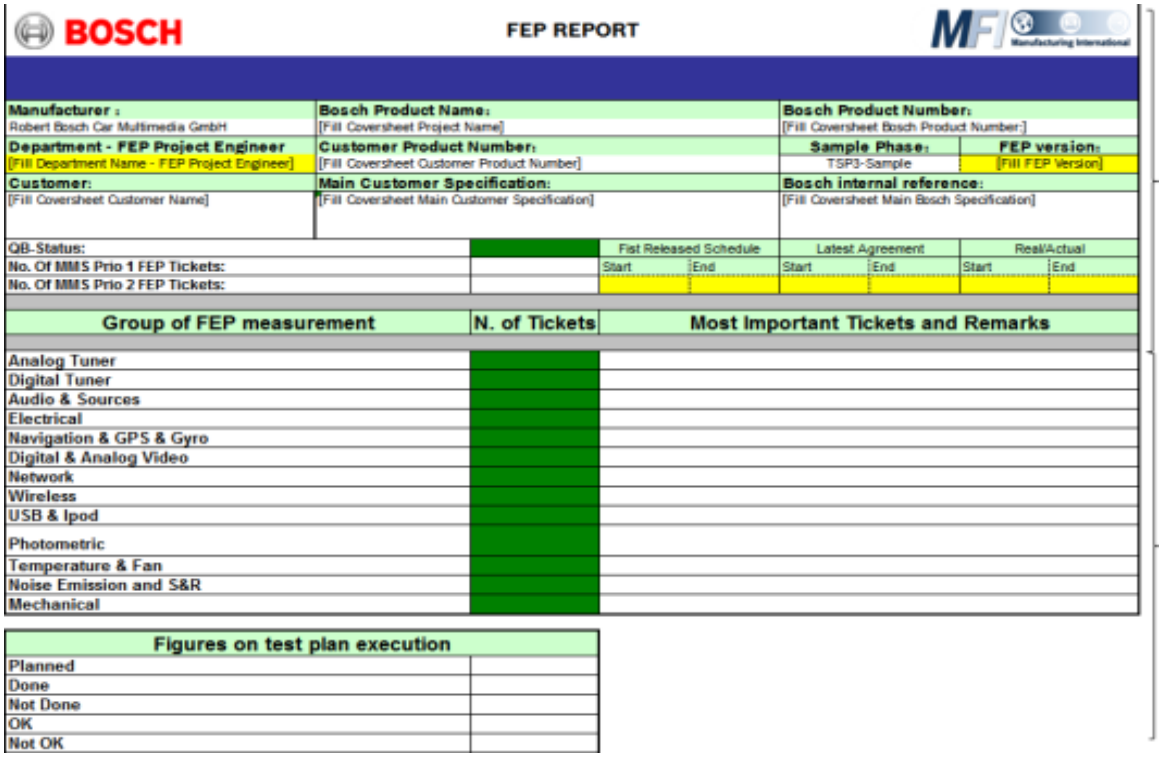
Final phase of PEP is, series startup and sending manufactured products to the customers in the fulfilment of delivery and continuous improvement with customer acceptance. In this PEP process, validation of the products takes place in three phases of PEP for all the products but it has variations according to the customer specifications of each product. These tests are validating, characteristic tests, functional tests, etc.

The main three validation phases or different validation process in distinct phases of the product are:

- Testing Process in the Development Phase of the Product – Product Release & Inspection Plan (FEP)
- Testing Process in the Production Line – Process Alignment Validation (PAV)
- Testing Process in the QMM-FA Laboratory for Claimed Products, products from the customers

3.2.1 Testing Process in Development Phase of the CM Product – Product Release & Inspection Plan (FEP)

During the development of the product, a number of prototypes are built and tested. Even though they are not made from production components, prototypes emulate production products as closely as possible. These alpha prototypes are necessary to determine whether the performance of the product matches the specifications and also to uncover design shortfalls. Later prototypes are built from the first production components received from the suppliers. Testing procedures in this development phase are follow special templates or set of testing parameters, called FEP database. A FEP template is shown in the following figures.



FEP REPORT

Manufacturer : Robert Bosch Car Multimedia GmbH	**Bosch Product Name:** [Fill Coversheet Project Name]		**Bosch Product Number:** [Fill Coversheet Bosch Product Number:]
Department - FEP Project Engineer [Fill Department Name - FEP Project Engineer]	**Customer Product Number:** [Fill Coversheet Customer Product Number]	**Sample Phase:** TSP3-Sample	**FEP version:** [Fill FEP Version]
Customer: [Fill Coversheet Customer Name]	**Main Customer Specification:** [Fill Coversheet Main Customer Specification]		**Bosch internal reference:** [Fill Coversheet Main Bosch Specification]

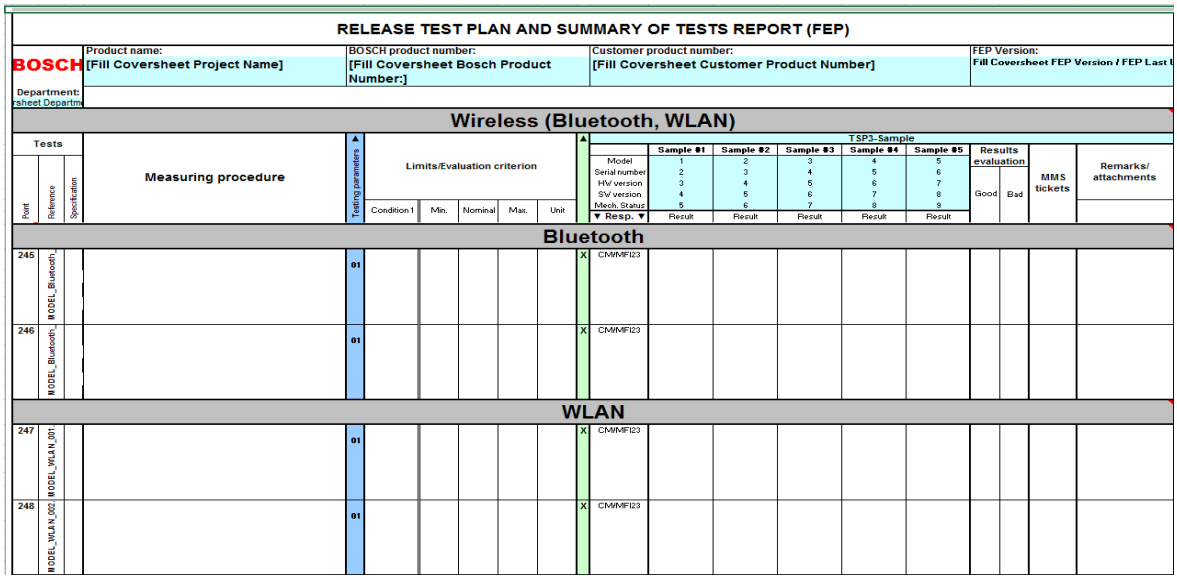
		Fist Released Schedule		Latest Agreement		Real/Actual	
QB-Status:							
No. Of MMS Prio 1 FEP Tickets:		Start	End	Start	End	Start	End
No. Of MMS Prio 2 FEP Tickets:							

Group of FEP measurement	N. of Tickets	Most Important Tickets and Remarks
Analog Tuner		
Digital Tuner		
Audio & Sources		
Electrical		
Navigation & GPS & Gyro		
Digital & Analog Video		
Network		
Wireless		
USB & Ipod		
Photometric		
Temperature & Fan		
Noise Emission and S&R		
Mechanical		

Figures on test plan execution	
Planned	
Done	
Not Done	
OK	
Not OK	

Figure 25 Cover Page of the FEP Report

Figure 25 defines a group of FEP measurement where the different modules present in the product are listed. This may include the Analog Tuner, Digital Tuner, etc. At this project beginning phase, FEP test team needs to analyses HW and SW specifications with customer requirements. It is a long duration testing procedure, so that it can absorb the characteristics and functionalities of the products to assure its quality. In this testing phase, specifications should be the ones specified in the world-wide standards of that module.



RELEASE TEST PLAN AND SUMMARY OF TESTS REPORT (FEP)

BOSCH	Product name: [Fill Coversheet Project Name]	BOSCH product number: [Fill Coversheet Bosch Product Number:]	Customer product number: [Fill Coversheet Customer Product Number]	FEP Version: Fill Coversheet FEP Version / FEP Last
Department: rsheet Departm				

Wireless (Bluetooth, WLAN)

Tests			Measuring procedure	Testing parameters	Limits/Evaluation criterion						TSP3-Sample					Results evaluation		MMS tickets	Remarks/ attachments
Point	Reference	Specification			Condition 1	Min.	Nominal	Max.	Unit		Sample #1	Sample #2	Sample #3	Sample #4	Sample #5	Good	Bad		
											Model	1	2	3	4	5				
											Serial number	2	3	4	5	6				
											HW version	3	4	5	6	7				
											SW version	4	5	6	7	8				
											Mech. Status	5	6	7	8	9				
											▼ Resp. ▼	Result	Result	Result	Result	Result				
Bluetooth																			
245	MODEL_Bluetooth_			01						X	CMMFI23								
246	MODEL_Bluetooth_			01						X	CMMFI23								
WLAN																			
247	MODEL_WLAN_001			01						X	CMMFI23								
248	MODEL_WLAN_002			01						X	CMMFI23								

Figure 26 Test Parameters of the Modules

Figure 26 shows the test parameters and its specifications for the different modules from the FEP. The testing process in FEP includes:

1. RF Characteristics of Antenna Interface
2. Volume Characteristics Via BT
3. Receiver Characteristics: Reference Sensitivity level
4. Frequency Response Via BT
5. Distortion MP3
6. Signal to Noise Ratio MP3
7. Channel Separation
8. Performing Required Tests in different Voltage Supply/ Room Temperature
    - Nominal Voltage Supply – 13.5V
    - Under Voltage Supply – 10.8V
    - Over Voltage Supply – 15.6V

3.2.2 Testing Process in the Production Line – Process Alignment Validation (PAV)

Testing process in manufacturing units after production of the unit is called as Process Alignment Validation. This PAV document and testing variables will have variations for other products. This Test and Alignment Regulations are also framed by Bosch according to the customer specification of each product and should be performed for all the manufactured units.

PAV test plan has to assure that tons of unit's functions as expected, look great, and go together quickly and easily every time, meeting all functional and cosmetic/appearance requirements, with great manufacturability metrics, i.e. process capabilities, first pass yield, rolling throughput yield. The purpose of the PAV test plan is,

- To verify mass production yields at mass production speeds, (INSTRUMENTAL, 2017)
- Validate and qualify additional tools needed to support quantities for early ramp (INSTRUMENTAL, 2017)

As all the manufactured units are intended to be sold to customers, this test should be done after manufacturing each product. For the NISSAN A-IVI SCOPE_1 product, the following functional parameters are tested:

1. Checking Bluetooth Software Version
2. Checking Bluetooth Hardware Version

3. Checking the Status of Pairing with Bluetooth products
4. Checking Link Quality
5. Checking Received Signal Strength Indicator
6. Reading Bluetooth Address
7. Audio Loopback Test
8. Channel Equality Test

3.3 Testing of 0KM/Field Products in QMM-FA

In QMM-FA laboratory, claimed products from the automobile companies are examined. After manufactured, products are distributed to the automobile companies and although previous testing was done, they may still fail while fixing in the automobiles. In such a case the auto mobile companies send the product back to BrgP to claim the product's warranty. Claimed products are received by the QMM-FA department and undergo new tests. Figure 27 describes the testing procedure in QMM-FA laboratory. In QMM-FA laboratory testing the BT modules is implemented by using the commercial smart phones and performing functional tests.

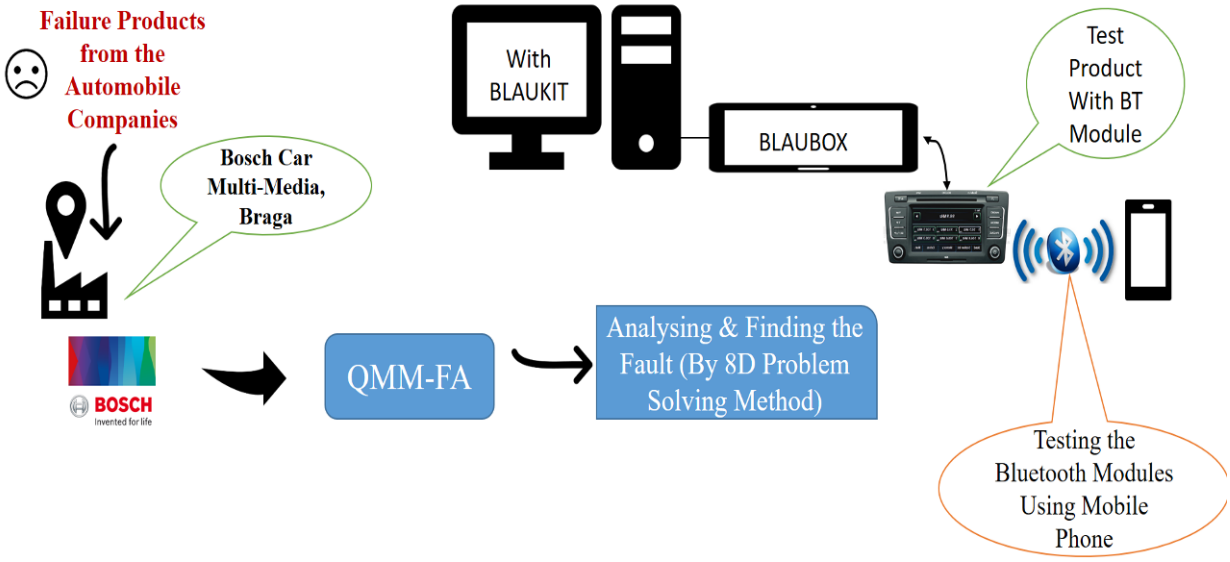


Figure 27 Present Testing Procedure in QMM-FA Laboratory

The tests that are performed are:

- Pairing with the Commercial smartphones
- Checking the connection between the smartphones and modules
- Checking the Audio Streaming

- Checking the status of contacts synchronization
- Calling to the contacts & checking the call function

In QMM-FA, all the PCs have BLAUKIT software and are connected with the BLAUBOX. The claimed product is then connected in the BLAUBOX, in the BLAUKIT through the commands products were commanded to turn on. Smartphones are used to test these above functional tests of BT modules. Initially, the smart phone is paired with the CM product and the functions will be tested in the customer mode. The results are filled in the IQIS database and reported to the customers.

3.4 Critical Review of the Testing Methodology and Identification of the Problem

This Master's thesis is intended to develop a specific testing procedures and test setup to test the claimed products from the customers. This test should validate the characteristics and functionalities according to the Bosch internal testing standards. The analysis made about the existing testing process in the QMM-FA laboratory, showed that current methodology does not guarantee all the requirements from the customer. There is a then need for defining tests that should cover all the above three testing validation processes. So, the proposed testing methodology should cover the FEP and PAV tests to accomplish Bosch standards. The present method of testing is just performing some functional tests so; there is no need to include in the proposed methodology.

4. PROPOSED TESTING METHODOLOGY

This chapter presents the proposed testing methodology for QMM-FA department to improve the existing testing process. In the first section, we describe the overall architecture and its blocks. Next section is about the communication between the blocks through GPIB connector. Third section describes the proposed test plan/test description. Final section elaborates the program coding developed in BLAUKIT to implement the tests automatically.

4.1 Block Diagram of Proposed Testing Method

Figure 28 Block Diagram of Proposed Testing System Figure 28shows the block diagram of the proposed system.

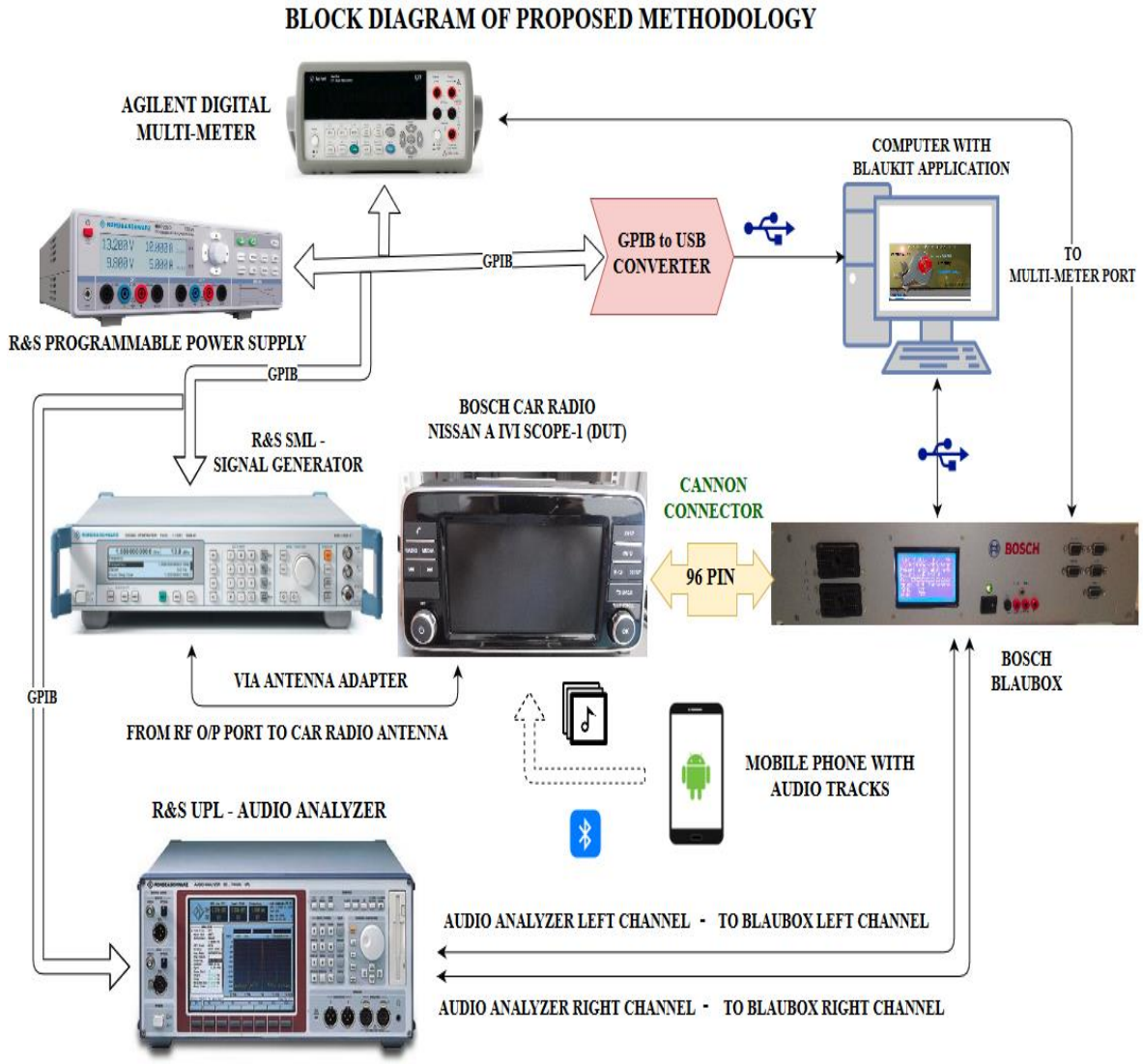


Figure 28 Block Diagram of Proposed Testing System

The proposed architecture includes the following:

1. Bosch BLAUBOX & Computer with BLAUKIT
2. Bosch Car Radio – NISSAN A IVI Scope_1
3. Mobile Phone with Different Audio Tracks
4. Rohde & Schwarz UPL – Audio Analyzer
5. Rohde & Schwarz SML – Signal Generator
6. Rohde & Schwarz Programmable Power Supply
7. Agilent's Digital Multi-meter

In Bosch Group, they are using standard analyzing tools & software applications. These two analyzing tools are already described in the previous chapter-2. They are,

- BLAUBOX
- BLAUKIT – Software Application

Bosch CM division has diverse variety of car radios for different customers. The testing method is developed in the scope of this thesis, addressed the "NISSAN A IVI Scope_1" product. A new developed Car Radio with Wi-Fi and Bluetooth wireless connections. The main intention of this thesis is to develop a new testing procedure and test plan for this product with automatic configuration and controlling of connected equipment. The NISSAN A IVI Scope_1 is showed in Figure 29.

Figure 29 Bosch Car Radio - NISSAN A IVI SCOPE – 1

This car radio has the following specific system feature:

- Virtual Personal Assistant
- Google Automotive Link
- FOTA Red Band

- CD/DVD Drive
- Telematics Control Unit
- Audio MIC/AUX
- Wi-Fi
- Bluetooth V4.0 Connectivity
- Video IN (AVM, RVC)
- USB 4.0 Connectivity

Next block in the Block diagram is Mobile Phone with specific Audio Tracks. Table 9 shows the number of audio tracks which were used during the testing procedure and sent to the DUT from the Mobile Phone via Bluetooth connectivity. Basically, these files contain the audio tracks with different frequencies and formats. Theses audio tracks are used to test the audio signal from the Bluetooth module of the radio according to the Bosch internal standards.

Table 9 Standard Audio Tracks to Test the Bluetooth Audio

Folder	File name	Transfer rate	Contents	Time
F1_320KBPS	T01_MENUETTO.MP3	320kbps	Menuetto	3’32”
F2_256KBPS	T02_1KHZ_SINE_WAVE.MP3	256kbps	1kHz Sine Wave 0dB L&R	56”
F3_192KBPS	T03_17HZ_SINE_WAVE.MP3	192kbps	17Hz Sine Wave 0dB L&R	56”
F4_128KBPS	T04_127HZ_SINE_WAVE.MP3	128kbps	127Hz Sine Wave 0dB L&R	56”
F5_96KBPS	T05_997HZ_SINE_WAVE.MP3	96kbps	997Hz Sine Wave 0dB L&R	56”
F6_64KBPS	T06_10007HZ_SINE_WAVE.MP3	64kbps	10,007Hz Sine Wave 0dB L&R	56”
F7_48KBPS	T07_19997HZ_SINE_WAVE.MP3	48kbps	19,997Hz Sine Wave 0dB L&R	56”
F8_32KBPS	T08_INFINITY_ZERO.MP3	32kbps	Infinity zero −∞ L&R	56”
F9_VBR	T09_1KHZ_SINE_WAVE.MP3	VBR	1kHz Sine Wave 0dB L	56”
	T10_10KHZ_SINE_WAVE.MP3		10kHz Sine Wave 0dB L	56”
	T11_1KHZ_SINE_WAVE.MP3		1kHz Sine Wave 0dB R	56”
	T12_10KHZ_SINE_WAVE.MP3		10kHz Sine Wave 0dB R	56”
	T13_4KHZ_SINE_WAVE.MP3		4kHz Sine Wave −20dB L&R	56”
	T14_16KHZ_SINE_WAVE.MP3		16kHz Sine Wave −20dB L&R	56”
	T15_100HZ_SINE_WAVE.MP3		100Hz Sine Wave −20dB L&R	56”
	T16_1KHZ_SINE_WAVE.MP3		1kHz Sine Wave −20dB L&R	56”
	T17_10KHZ_SINE_WAVE.MP3		10kHz Sine Wave −20dB L&R	55”
	T18_997HZ_SINE_WAVE.MP3		997Hz Sine Wave −60dB L&R	59”
	T19_CLAIR_DE_LUNE.MP3		Clair de Lune L&R	3’28”
	T20_OUVERTURE_MINIATURE.MP3		Ouverture Miniature L&R	3’20”
	T21_BLANK.MP3		Blank L&R	27’12”
	T22_MARCHE.MP3		Marche L&R	2’27”
			Total time	55’53”

VBR = Variable Bit Rate

Next block is Rohde & Schwarz UPL Audio Analyzer; Functionalities were explained in the before section 2.5 (Refer for more details). Next block in the block diagram is Rohde & Schwarz SML Signal Generator. Here in this proposed test plan it’s used only in one test i.e. comparing the FM signal & Bluetooth Signal by sending the 1 KHz Audio Signal in both.

This signal generator is configured as to send the FM of specified frequency to the DUT. SML – Signal Generator's front view and back side ports are showed in Figure 30. Connection and configuration of the SML – Signal Generator is explained in section 4.2 (Refer for more details).

Figure 30 R&S SML - Signal Generator

Next in the block diagram is Rohde & Schwarz HMP2020 - Programmable Power Supply. This equipment is used to provide the configured voltage supply to the DUT. According the configuration in proposed test plan, programmable power supply is configured remotely to provide three different types of voltages in three different cases of the test plan. Configured voltages supplies are:

1. Nominal Voltage Supply – 13.5 V
2. Under Voltage Supply – 10.8 V
3. Over Voltage Supply – 15.6 V

The test plan is framed to test the DUT in this three different voltage supplies to prove the stability of the DUT.

Next equipment in the proposed system is Agilent's Digital Multi-Meter. This multi-meter is used to measure the voltage and current consumption of the DUT while performing the tests in different cases. These measurements are acquired remotely through a GPIB connector. Agilent's Digital Multi-meter is showed in Figure 31. Connection through GPIB connector is explained in the following section (For more details refer section 4. 2).

Figure 31 Agilent's Digital Multi-Meter

4.2 Equipment's Connection, Configuration & Controlling Through GPIB Connector

Commonly in all the industries, GPIB connectors are mainly used to configure, control & operate all the kinds of equipment through remotely, where as in this proposed test system National Instrument (NI)'s GPIB connectors are used to develop the test system to configure required functions in the different tests and acquire data in all the tests to perform some calculations to evaluate the audio signal of the Bluetooth module. Figure 35 shows some information on the GPIB connection with the computer. Figure 32 is showing the GPIB connector, which has a USB convertor to communicate with the computer. In the proposed testing setup, all the five different types of equipment, have a GPIB port in their back side. So all the equipment are connected through GPIB connector.

Figure 32 GPIB Connector (NationalInstruments, 2017)

Figure 33 shows the application software installed in the computer to control and verify the connection in between the equipment.

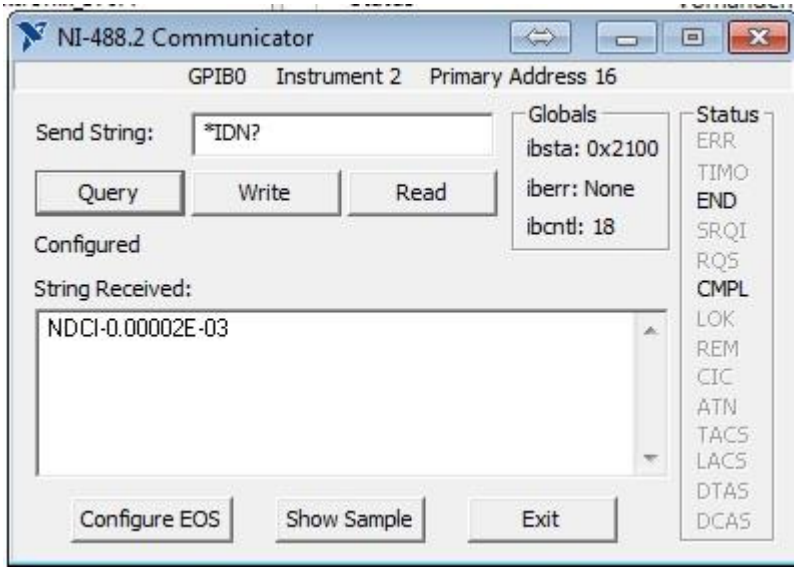


Figure 33 NI-488 Driver Communicator – Application

Equipment are inter connected by the Original Equipment Manufacturer(OEM) GPIB cables and one of the equipment cable is connected with GPIB-USB converter to make the connection with the computer. Figure 34 shows the OEM GPIB cables used in industries. Universally, all the equipment are having the OEM GPIB cable ports to enable the communication through GPIB connectors.

Figure 34 Commercial OEM GPIB cable

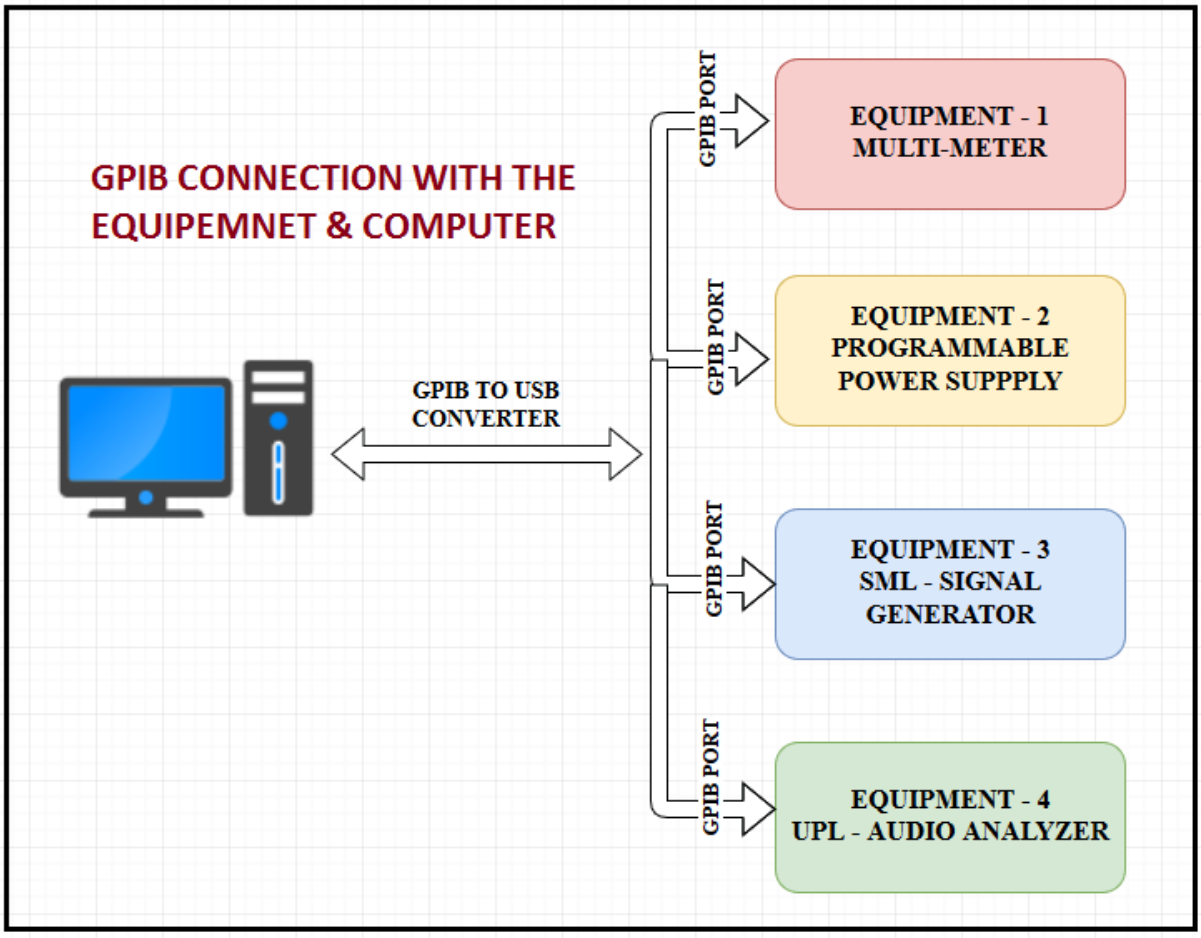


Figure 35 GPIB Connection in Between Equipment

4.3 Proposed Test Plan and Description of Tests

Proposed test plan is based on the "Product Release & Inspection Plan (FEP)" and on the "Process Alignment Validation (PAV)" tests. The proposed plan has three test cases; they are:

1. Tests in Nominal Voltage Supply
2. Tests in Under Voltage Supply
3. Tests in Over Voltage Supply

Table 10 Summary of the Proposed Test Plan

Test Number	Name of the Test
Test Case 1: Performing Test in the Nominal Voltage Supply 13.5 Volts	
1	Comparing FM signal & Bluetooth Signal by sending 1 KHz Audio

	Signal
2.	Frequency Response via BT – Ref. 1 KHz Signal a) Low Frequency Audio Signal - 17 Hz b) High Frequency Signal – 19.999 KHz
3.	Distortion MP3 (Distortion ratio (THD+N))
4.	Signal to Noise Ratio (SNR) a) 1 KHz/0 dB Signal b) Infinity Zero – Without Signal
5.	Volume Characteristics Testing the Volume from 0 Volume Step – 40 Volume Step
6.	Channel Equality Ref. to Left Channel a) Testing Front Channel (Right & Left) b) Testing Rear Channel (Right & Left)
7.	Channel Separation a) Testing the Left Channel b) Testing Right Channel
Test Case 2: Performing Tests in the Under Voltage Supply 10.8 Volts	
8.	Frequency Response via BT – Ref. 1 KHz Signal a) Low Frequency Audio Signal - 17 Hz b) High Frequency Signal – 19.999 KHz
9.	Distortion MP3 (Distortion ratio (THD+N))
10.	Signal to Noise Ratio (SNR) a) 1 KHz/0 dB Signal b) Infinity Zero – Without Signal
11.	Channel Equality Ref. to Left Channel

	a) Testing Front Channel (Right & Left) b) Testing Rear Channel (Right & Left)
12.	Channel Separation a) Testing the Left Channel b) Testing Right Channel
Test Case 3: Performing Tests in the Over Voltage Supply 15.6 Volts	
13.	Frequency Response via BT – Ref. 1 KHz Signal a) Low Frequency Audio Signal - 17 Hz b) High Frequency Signal – 19.999 KHz
14.	Distortion MP3 (Distortion ratio (THD+N))
15.	Signal to Noise Ratio (SNR) a) 1 KHz/0 dB Signal b) Infinity Zero – Without Signal
16.	Channel Equality Ref. to Left Channel a) Testing Front Channel (Right & Left) b) Testing Rear Channel (Right & Left)
17.	Channel Separation a) Testing the Left Channel b) Testing Right Channel

In the test case 1, seven different types of tests are performed. These tests are done in the nominal voltage supply, i.e. Supplied voltage to DUT is 13.5 Volts. In the test case 2, five tests are performed with the voltage supply of 10.8 Volts. Finally, the test case 3 also has a five different tests with the voltage supply of 15.6 Volts. Even though these test cases are performed in different voltages still the results in all the cases should be the same to prove that the DUT is stable to the changes in the supply voltage. Developed test plan for testing Bluetooth Audio Signal is available in the "ATTACHMENT_NO.1" excel file and the

description of individual tests, configurations and evaluation of the results are explained in following sub sections.

4.3.1 Comparing FM Signal and Bluetooth Signal by Sending 1 KHz Audio Signal

This is the first test in the proposed test plan and it is performed only in the first test case which is Nominal Voltage Supply to the DUT. Basically this test is performed to see how the DUT behaving in different sources with the same audio signal. In this case, signal generator is configured to send the 1 KHz Frequency Modulated signal to the DUT and also 1 KHz audio signal through BT. This test is performed with the reference in left channel.

A. **Reference:** Set in Audio Analyzer - Via Bluetooth sending 1 KHz Audio Signal I.e. playing the Audio Track F1_320KBPS_T02_1KHz_SINE_WAVE.mp3 in the mobile phone which is connected to the DUT via DUT and keeping 1.40 Volts (Approx.) in the Left Channel of the DUT by adjusting the volume of DUT
B. **Audio Track:** F1_320KBPS_T02_1KHz_SINE_WAVE.mp3
C. **Configuration in Signal Generator - SML:** Configurations to be done in the signal generator are specified in the Table 11.

Table 11 Configurations in Signal Generator – SML in Test 1

S.No.	Variables	Values
1.	Frequency	95.3 MHz or 98 MHz (Front End Tuner)
2.	Modulation	FM
3.	Level	52.0 dB-µV
4.	FM Deviation	22.500 KHz
5.	FM Source	LF Generator
6.	EXT Coupling	AC
7.	LF Generation Frequency	1.000 KHz
8.	FM Bandwidth	Standard – with FM Offset

D. **Configuration in Audio Analyzer – UPL:** Configurations to be done in the audio analyzer are as in Table 12. Measurements to be made in the Front Channel of the Audio analyzer.

Table 12 Configuration of Audio Analyzer in Test 1

S.No.	Configuration	Condition
1.	Function	RMS & S/N
2.	Filter Number: - 5	LP_20.0 KHz to be in ON
3.	Filter Number: - 6	HP_22.0 Hz to be in ON

E. **Configuration in DUT:** Volume should be adjusted to keep the reference value in Audio analyzer and it should be constant all over the test.

F. **Expected Results in both Measurements (FM Signal & BT Signal):** Expected results are showed in Table 13**.**

Table 13 Expected Measurement Results in Test No.1

Minimum	Nominal	Maximum	Unit
FM SIGNAL MEASUREMENT			
-8.00	Should be in this Range	-12.00	dB
BT SIGNAL MEASUREMENT			
-0.8	CH 1	0.6	dB
-0.9	CH 2	0.6	dB

4.3.2 Frequency Response via BT

In this frequency response test, low and high frequency audio signals are sent and measurements are made with the required configurations. This test is performed in all the three test cases.

I. Measurement in Low Frequency Signal – 17 Hz

This is the first step in the frequency response test and a very low frequency audio signal is send to the DUT through mobile phone which is connected via BT of DUT.

A. **Reference:** Set in Audio Analyzer - Via Bluetooth sending 1 KHz Audio Signal I.e. playing the Audio Track F1_320KBPS_T02_1KHz_SINE_WAVE.mp3 in the mobile phone which is connected to the DUT via DUT and keeping 1.40 Volts (Approx.) in the Left Channel of the DUT by adjusting the volume of DUT

B. **Audio Track:** F1_320KPBS => T03_17Hz_SINE_WAVE.mp3

C. **Configuration in Signal Generator - SML:** No need to configure the Signal generator in this test. Because in this test it's not going to be used.

D. **Configuration in Audio Analyzer – UPL:** Configurations to be done in the audio analyzer are as in Table 14. Measurements to be made in the Front Channel of the Audio analyzer.

Table 14 Configuration of Audio Analyzer in the measurement in low frequency signal

S.No.	Configuration	Condition
1.	Function	RMS & S/N
2.	Filter Number: - 5	LP_20.0 KHz to be in ON
3.	Filter Number: - 6	HP_22.0 Hz to be in OFF

E. **Configuration in DUT:** Volume should be adjusted to keep the reference value in Audio analyzer and it should be constant all over the test.

F. **Expected Results in both Measurements:** Expected results for frequency response in low frequency audio signal is showed in Table 15**.**

Table 15 Expected Measurement Results in Test No.2

Channel	Minimum	REF.	Maximum	Unit
Left	-3.00	0.00	3.00	dB
Right	-3.00	0.00	3.00	dB

II. Measurement in High Frequency Signal – 19.999 KHz

This is the second step in the frequency response test and very high frequency audio signal is send to the DUT through mobile phone which is connected via BT of DUT.

A. **Reference:** Set in Audio Analyzer - Via Bluetooth sending 1 KHz Audio Signal I.e. playing the Audio Track F1_320KBPS_T02_1KHz_SINE_WAVE.mp3 in the mobile phone which is connected to the DUT via DUT and keeping 1.40 Volts (Approx.) in the Left Channel of the DUT by adjusting the volume of DUT

B. **Audio Track:** F1_320KPBS => T07_19.99KHz_SINE_WAVE.mp3

C. **Configuration in Signal Generator - SML:** No need to configure the Signal generator in this test. Because in this test it's not going to be used.

D. **Configuration in Audio Analyzer – UPL:** Configurations to be done in the audio analyzer are as in Table 16. Measurements to be made in the Front Channel of the Audio analyzer.

Table 16 Configuration of Audio Analyzer in the measurement in high frequency signal

S.No.	Configuration	Condition
1.	Function	RMS & S/N
2.	Filter Number: - 5	LP_20.0 KHz to be in ON
3.	Filter Number: - 6	HP_22.0 Hz to be in OFF

E. Configuration in DUT: Volume should be adjusted to keep the reference value in Audio analyzer and it should be constant all over the test.

F. Expected Results in both Measurements: Expected results for frequency response in high frequency audio signal is showed in Table 15.

4.3.3 Distortion MP3 (THD+N)

This is the third test and is used to measure distortion ratio present in the BT audio signal. This test is performed in all the three test cases.

A. Reference: Set in Audio Analyzer - Via Bluetooth sending 1 KHz Audio Signal I.e. playing the Audio Track F1_320KBPS_T02_1KHz_SINE_WAVE.mp3 in the mobile phone which is connected to the DUT via DUT and keeping 1.40 Volts (Approx.) in the Left Channel of the DUT by adjusting the volume of DUT

B. Audio Track: F1_320KBPS_T02_1KHz_SINE_WAVE.mp3

C. Configuration in Signal Generator - SML: No need to configure the Signal generator in this test. Because in this test it's not going to be used.

G. **Configuration in Audio Analyzer – UPL:** Configurations to be done in the audio analyzer are as in Table 17. Measurements to be made in the Front Channel of the Audio analyzer.

Table 17 Configuration of Audio Analyzer in Test 3

S.No.	Configuration	Condition
1.	Function	THD/SINAD
2.	Filter Number: - 5	LP_20.0 KHz to be in ON
3.	Filter Number: - 6	HP_22.0 Hz to be in ON

D. **Configuration in DUT:** Volume should be adjusted to keep the reference value in Audio analyzer and it should be constant all over the test.

E. Expected Results: Expected results for measurement of distortion ratio is should be **<=0.1 %** in both channels **(Right & Left)**.

4.3.4 Signal to Noise Ratio – SNR

This signal to noise ratio measurement is calculated according to Equation 1 and is performed for all the three test cases. In this test two different audio signals are used to measure the SNR. According to Equation 1, reference signal value is measured with the 1 KHz audio signal and noise value is measured using the infinity zero audio signal.

Equation 1 Calculation of Signal to Noise Ratio

Signal to Noise Ratio (SNR) = Ref. Signal Value – Measured Noise Value

I. 1 KHz with 0 dB Signal

Configurations for this step is explained below. In the end of this step ref. signal value in both channels are measured and noted for further calculations.

A. Reference: Set in Audio Analyzer - Via Bluetooth sending 1 KHz Audio Signal I.e. playing the Audio Track F1_320KBPS_T02_1KHz_SINE_WAVE.mp3 in the mobile phone which is connected to the DUT via DUT and keeping 1.40 Volts (Approx.) in the Left Channel of the DUT by adjusting the volume of DUT.

B. Audio Track: F1_320KBPS_T02_1KHz_SINE_WAVE.mp3

C. Configuration in Signal Generator - SML: No need to configure the Signal generator in this test. Because in this test it's not going to be used.

D. **Configuration in Audio Analyzer – UPL:** Configurations to be done in the audio analyzer are as in Table 18. Measurements to be made in the Front Channel of the Audio analyzer.

Table 18 Configuration of Audio Analyzer in Measurement of SNR

S.No.	Configuration	Condition
1.	Function	THD/SINAD
2.	Filter Number: - 5	LP_20.0 KHz to be in ON
3.	Filter Number: - 6	HP_22.0 Hz to be in ON

E. **Configuration in DUT:** Volume should be adjusted to keep the reference value in Audio analyzer and it should be constant all over the test

II. Infinity Zero Signal

Configurations for this step is explained below. In the end of this step noise value in both channels are measured and noted for further calculations.

A. **Reference:** Set in Audio Analyzer - Via Bluetooth sending 1 KHz Audio Signal I.e. playing the Audio Track F1_320KBPS_T02_1KHz_SINE_WAVE.mp3 in the mobile phone which is connected to the DUT via DUT and keeping 1.40 Volts (Approx.) in the Left Channel of the DUT by adjusting the volume of DUT
B. **Audio Track:** F1_320KBPS_T08_1KHz_SINE_WAVE.mp3
C. **Configuration in Signal Generator - SML:** No need to configure the Signal generator in this test. Because in this test it's not going to be used.
F. **Configuration in Audio Analyzer – UPL:** Configurations to be done in the audio analyzer are as in Table 19. Measurements to be made in the Front Channel of the Audio analyzer.

Table 19 Configuration of Audio Analyzer in Measurement of SNR

S.No.	Configuration	Condition
1.	Function	THD/SINAD
2.	Filter Number: - 5	LP_20.0 KHz to be in ON
3.	Filter Number: - 6	HP_22.0 Hz to be in ON

D. **Configuration in DUT:** Volume should be adjusted to keep the reference value in Audio analyzer and it should be constant all over the test.

III. SNR Calculation – Expected Values

By using the Equation 1 the SNR is calculated and the expected result is, the value of the calculated SNR should be **minimum 70.00 dB** at least in both the channels **(Left & Right)**.

4.3.5 Volume Characteristics

In NISSAN A IVI SCOPE_1 product has different volume steps from 0 to 40. This volume characteristics measurements takes place from 0^{th} volume step until 40^{th} volume step of DUT. This test performed only in the first test case.

A. **Reference:** Set in Audio Analyzer - Via Bluetooth sending 1 KHz Audio Signal I.e. playing the Audio Track F1_320KBPS_T16_1KHz_SINE_WAVE.mp3 in the mobile phone which is connected to the DUT via DUT and keeping 2.0 Volts (Approx.) in the

Left Channel of the DUT by adjusting the volume of DUT which is the maximum volume step of the DUT.

B. Audio Track: F1_320KBPS_T16_1KHz_SINE_WAVE.mp3

C. Configuration in Signal Generator - SML: No need to configure the Signal generator in this test. Because in this test it's not going to be used.

G. **Configuration in Audio Analyzer – UPL:** Configurations to be done in the audio analyzer are as in Table 20. Measurements to be made in the Front Channel of the Audio analyzer.

Table 20 Configuration of Audio Analyzer in volume characteristics

S.No.	Configuration	Condition
1.	Function	THD/SINAD
2.	Filter Number: - 5	CCIR Unweighted to be in ON
3.	Filter Number: - 6	HP_22.0 Hz to be in OFF

D. Configuration in DUT: Volume of the DUT is increased from 0^{th} Volume step to 40^{th} volume step to measure the values in channel left & right respectively the 41 testing parameters from 01 to 41.

E. Expected Results: It's showed in the following Table 21 and it's the same for both the channels of left & right from 0^{th} volume step to 40^{th} volume step.

Table 21 Expected Values for Volume Characteristics Measurements

S.No.	Volume Step	Minimum	Nominal	Unit
1	00	-83	± 1	dB
2	01	-79	± 1	dB
3	02	-71	± 1	dB
4	03	-63	± 1	dB
5	04	-57	± 1	dB
6	05	-53	± 1	dB
7	06	-50	± 1	dB
8	07	-47	± 1	dB
9	08	-45	± 1	dB
10	09	-43	± 1	dB
11	10	-41	± 1	dB
12	11	-39	± 1	dB
13	12	-37	± 1	dB
14	13	-35	± 1	dB
15	14	-34	± 1	dB
16	15	-32	± 1	dB

17	16	-31	± 1	dB
18	17	-30	± 1	dB
19	18	-29	± 1	dB
20	19	-27	± 1	dB
21	20	-26	± 1	dB
22	21	-25	± 1	dB
23	22	-23	± 1	dB
24	23	-22	± 1	dB
25	24	-21	± 1	dB
26	25	-19	± 1	dB
27	26	-18	± 1	dB
28	27	-17	± 1	dB
29	28	-15	± 1	dB
30	29	-14	± 1	dB
31	30	-13	± 1	dB
32	31	-12	± 1	dB
33	32	-10	± 1	dB
34	33	-9	± 1	dB
35	34	-8	± 1	dB
36	35	-6	± 1	dB
37	36	-5	± 1	dB
38	37	-4	± 1	dB
39	38	-2	± 1	dB
40	39	-1	± 1	dB
41	40	0	± 1	dB

4.3.6 Channel Equality

Channel equality test is used to measure the equality between the channels in Front – Left & Right and in Rear Left & Right channels. This test has a two steps, first is the measurement in Front Channel's Right & Left channels and next one is the measurement in Rear Channel's Right & Left.

I. Testing in Front Channel's Left & Right

A. Reference: Set in Audio Analyzer - Via Bluetooth sending 1 KHz Audio Signal I.e. playing the Audio Track F1_320KBPS_T02_1KHz_SINE_WAVE.mp3 in the mobile phone which is connected to the DUT via DUT and keeping 1.40 Volts (Approx.) in the Left Channel of the DUT by adjusting the volume of DUT

B. Audio Track: F1_320KPBS => T02_17Hz_SINE_WAVE.mp3

C. Configuration in Signal Generator - SML: No need to configure the Signal generator in this test. Because in this test it's not going to be used.

H. **Configuration in Audio Analyzer – UPL:** Configurations to be done in the audio analyzer are as in Table 22. Measurements to be made in the Front Channel of the Audio analyzer.

Table 22 Configuration of Audio Analyzer in channel equality

S.No.	Configuration	Condition
1.	Function	RMS & S/N
2.	Filter Number: - 5	LP_20.0 KHz to be in ON
3.	Filter Number: - 6	HP_22 Hz to be in ON

D. **Configuration in DUT:** Volume should be adjusted to keep the reference value in Audio analyzer and it should be constant all over the test.

E. Expected Results: For both the channels, nominal value should be ±1 dB

II. Testing in Rear Channel's Left & Right

A. Reference: Set in Audio Analyzer - Via Bluetooth sending 1 KHz Audio Signal I.e. playing the Audio Track F1_320KBPS_T02_1KHz_SINE_WAVE.mp3 in the mobile phone which is connected to the DUT via DUT and keeping 1.40 Volts (Approx.) in the Left Channel of the DUT by adjusting the volume of DUT

B. Audio Track: F1_320KPBS => T02_17Hz_SINE_WAVE.mp3

C. Configuration in Signal Generator - SML: No need to configure the Signal generator in this test. Because in this test it's not going to be used.

D. **Configuration in Audio Analyzer – UPL:** Configurations to be done in the audio analyzer are as in Table 23. Measurements to be made in the Rear Channel of the Audio analyzer.

Table 23 Configuration of Audio Analyzer in channel equality

S.No.	Configuration	Condition
1.	Function	RMS & S/N
2.	Filter Number: - 5	LP_20.0 KHz to be in ON
3.	Filter Number: - 6	HP_22 Hz to be in ON

E. **Configuration in DUT:** Volume should be adjusted to keep the reference value in Audio analyzer and it should be constant all over the test.

F. Expected Results: For both the channels, nominal value should be ±1 dB

4.3.7 Channel Separation

In this test, DUT is evaluated in two steps. First one is sending 1 KHz audio signal to the left channel of the DUT whereas in the right channel there is no signal with reference to the left channel. Second one is vice versa to the first one but with the reference value in right channel. This test is also performed in all the three test cases to prove the stability of the DUT.

I. Measurement in Left Channel

A. Reference: Set in Audio Analyzer - Via Bluetooth sending 1 KHz Audio Signal I.e. playing the Audio Track F1_320KBPS_T09_1KHz_SINE_WAVE.mp3 in the mobile phone which is connected to the DUT via DUT and keeping 1.40 Volts (Approx.) in the Left Channel of the DUT by adjusting the volume of DUT

B. Audio Track: F1_320KPBS => T09_1KHz_SINE_WAVE.mp3

C. Configuration in Signal Generator - SML: No need to configure the Signal generator in this test. Because in this test it's not going to be used.

D. **Configuration in Audio Analyzer – UPL:** Configurations to be done in the audio analyzer are as in Table 24. Measurements to be made in the Front Channel of the Audio analyzer.

Table 24 Configuration of Audio Analyzer in channel separation

S.No.	Configuration	Condition
1.	Function	RMS & S/N
2.	Filter Number: - 5	LP_20.0 KHz to be in ON
3.	Filter Number: - 6	HP_22 Hz to be in ON

E. **Configuration in DUT:** Volume should be adjusted to keep the reference value in Audio analyzer and it should be constant all over the test.

F. **Expected Results:** Measurement of channel separation in left channel, expected values are specified in the following Table 25**.**

Table 25 Measurement of Channel Separation in Left Channel

S.No.	Channel	Minimum Value	Maximum Value	Unit
1	Left Channel	-0.5	0.5	dB
2	Right Channel	-80.0	-70.0	dB

II. Measurement in Right Channel

A. Reference: Set in Audio Analyzer - Via Bluetooth sending 1 KHz Audio Signal I.e. Playing the Audio Track F1_320KBPS_T11_1KHz_SINE_WAVE.mp3 in the mobile phone which is connected to the DUT via DUT and keeping 1.40 Volts (Approx.) in the Right Channel of the DUT by adjusting the volume of DUT

B. Audio Track: F1_320KPBS => T11_1KHz_SINE_WAVE.mp3

C. Configuration in Signal Generator - SML: No need to configure the Signal generator in this test. Because in this test it's not going to be used.

G. **Configuration in Audio Analyzer – UPL:** Configurations to be done in the audio analyzer are as in Table 26. Measurements to be made in the Front Channel of the Audio analyzer.

Table 26 Configuration of Audio Analyzer in channel separation

S.No.	Configuration	Condition
1.	Function	RMS & S/N
2.	Filter Number: - 5	LP_20.0 KHz to be in ON
3.	Filter Number: - 6	HP_22 Hz to be in ON

D. **Configuration in DUT:** Volume should be adjusted to keep the reference value in Audio analyzer and it should be constant all over the test.

E. **Expected Results:** Measurement of channel separation in left channel, expected values are specified in the following Table 27**.**

Table 27 Measurement of Channel Separation in the Right Channel

S.No.	Channel	Minimum Value	Maximum Value	Unit
1	Right Channel	-0.5	0.5	dB
2	Left Channel	-80.0	-70.0	dB

4.4 Development of BLK Program Codes in BLAUKIT

This developed test plan is implemented in the BLAUKIT application software as a blk. script. The scripts are created using a pre-defined excel sheet that is then compiled to be executable in the BLAUKIT command line. BLAUKIT compiler is a set of excel macro files to create an executable format to the BLAUKIT application and also to protect the source programming script. The common blk. structure is showed in the Figure 36. For more details, an example of a blk. program structure is attached in the "ATTACHMENT_NO.2" excel file.

A blk. script has four different sections. For more details, refer “ATTACHMENT_No.3” excel file. The sections are:

I. Declarations

II. Calling the Tests & Developed Functions in the Command Line of the BLAUKIT

III. Auxiliary Sub-Routines & Functions

IV. DUT Test Sub-Routines

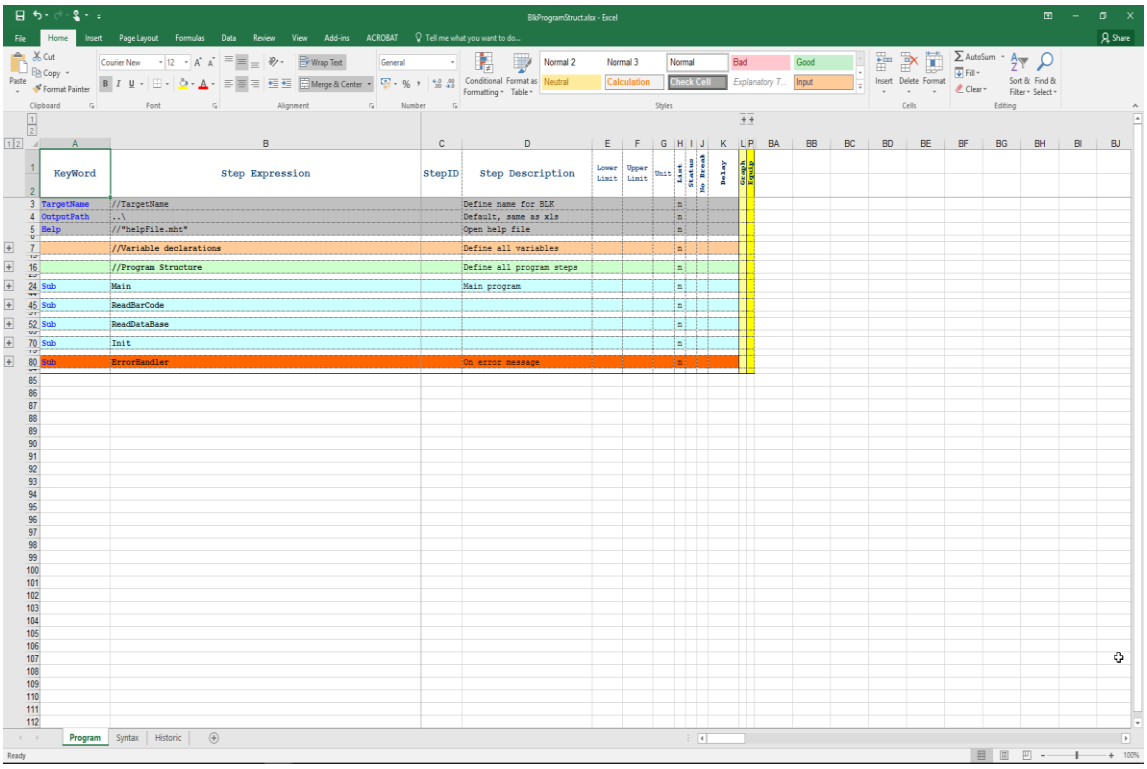


Figure 36 Common blk. Programming Structure from BrgP

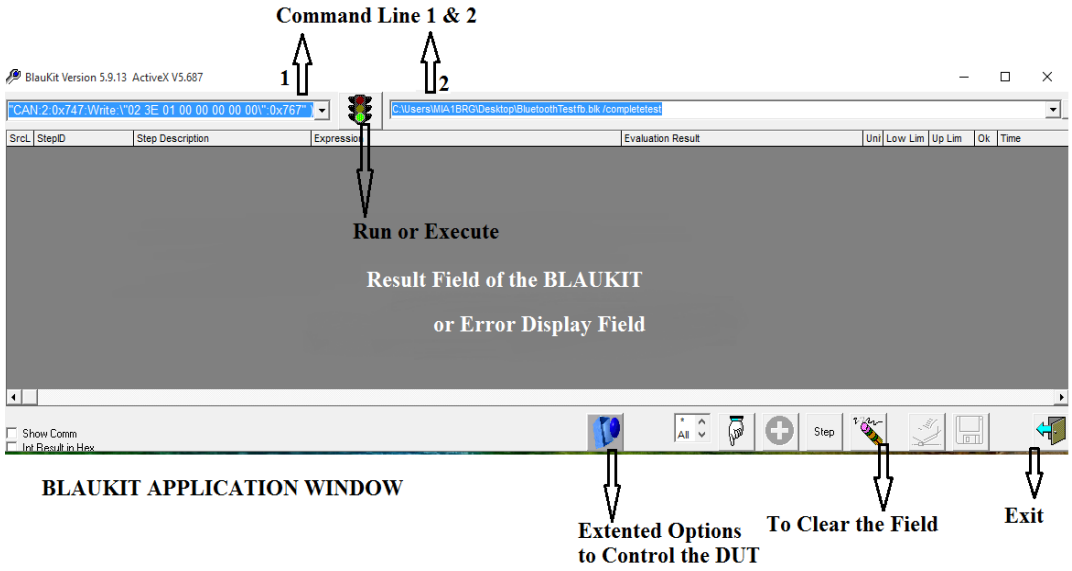


Figure 37 BLAUKIT Application Window

Section I is used to declare the global variables, BLAUKIT command line strings and developed functions in the section III. This block of the program is called as declaration section of the blk program script.

Section II is mainly used to specify sub-routines which is used in the tests and functions to enable the use of those sub-routines in the BLAUKIT command line. BLAUKIT has two command lines: one is used to execute the commands, syntax, etc., and another one is used to execute the program scripts in the blk formats and program scripts in text file format. A BLAUKIT command line is showed in the above Figure 37. Section III contains the auxiliary sub-routines & functions to help the section IV. A Section III, its actually helping the DUT test sub-routines to perform the DUT test cases. Finally, section IV contains the DUT Test sub-routines to perform the specific tests in the specific test cases. By using those sub-routines, it is possible to perform the complete test script of Bluetooth Audio Signal and also to perform specific tests if it is useful. These auxiliary sub-routines and functions are developed specially to perform particular operations. Those sub-routines & they're functionality are as follows,

- "PowerON" – To power ON the DUT via BLAUBOX
- "PowerOFF" – To power OFF the DUT via BLAUBOX
- "RFSGSMInit" – To initialize signal generator
- "AudioAnalyzerInit" – To initialize audio analyzer, turn ON
- "AudioAnalyzerConfigAsRMS" – To configure Audio Analyzer's Function as RMS
- "AudioAnalyzerConfigAsDistortion" – To configure Audio Analyzer's Function as Distortion
- "BlauboxInit" – To activate outputs to Audio Analyzer

Developed auxiliary functions are,

- Number AudioAnalyzerMeasure – Function to measure the values in channels of the Audio Analyzer
- Number AudioAnalyzerMeasureEx – To measure the expected value with the average of specified measurement
- Number AudioAnalyzerWaitforMeasurementValue – To measure the expected values until specified time
- Number VolumeControlbyVoltageLevel – To control the volume of the DUT by obtaining the voltage level difference between the volume steps of DUT

Developed sub-routines in the section IV are as follows,

- “PairMobilePhone” – To show the message box while performing the test to pair the mobile phone’s Bluetooth with the DUT’s Bluetooth.
- “ComparingFMwithBT” – To perform the test of “Comparing the FM Signal & Bluetooth Signal by Sending the 1 KHz Signal”. It enables the configurations and acquisition of data from all the used equipment.
- “FrequencyResponseViaBT” – It’s used to perform the “Frequency Response via BT” test.
- “DistortionMP3” – To enabling the DUT to perform the “Distortion MP3” test
- “SignaltoNoisRatio” – To perform the “Signal Noise Ratio” test.
- “ChannelEquality” – To enable the DUT to perform the “Channel Equality” test.
- “ChannelSeparation” – It’s used to perform the “Channel Separation” test.
- “VolumeCharacteristics” – To perform the “Volume Characteristics” test of the Bluetooth Audio signal of the DUT from 0^{th} volume step to 40^{th} volume step.
- “IncreaseVolumeviaCanBus” – To increase the volume of the DUT to specified level according to the voltage level of the volume step via CAN controller of the BLAUBOX
- “DecreaseVolumeviaCanBus” - To decrease the volume of the DUT to specified level according to the voltage level of the volume step via CAN controller of the BLAUBOX
- “ExternalPowerSupplyNominalVoltage” – To supply the DUT at the nominal voltage i.e. 13.5 Volts
- “ExternalPowerSupplyUnderVoltage “- To supply the DUT at the under voltage i.e. 10.8 Volts
- “ExternalPowerSupplyOverVoltage” - To supply the DUT at the over voltage i.e. 15.6 Volts
- “ExternalPowerSupplyOff” – To turn off the external power supply before turn off the DUT
- “MeasureConsumption” – To measure the current consumption of the DUT while turning ON
- “CompleteTest” – To perform all the tests in all three different test cases in the order of developed test plan document.

Figure 38 shows the flow of the complete test performed to evaluate the Bluetooth Audio Signal of the DUT. Three test cases are described separately in the following figures to have an overall idea about the test cases and how sub-routines and functions are used to perform a tests.

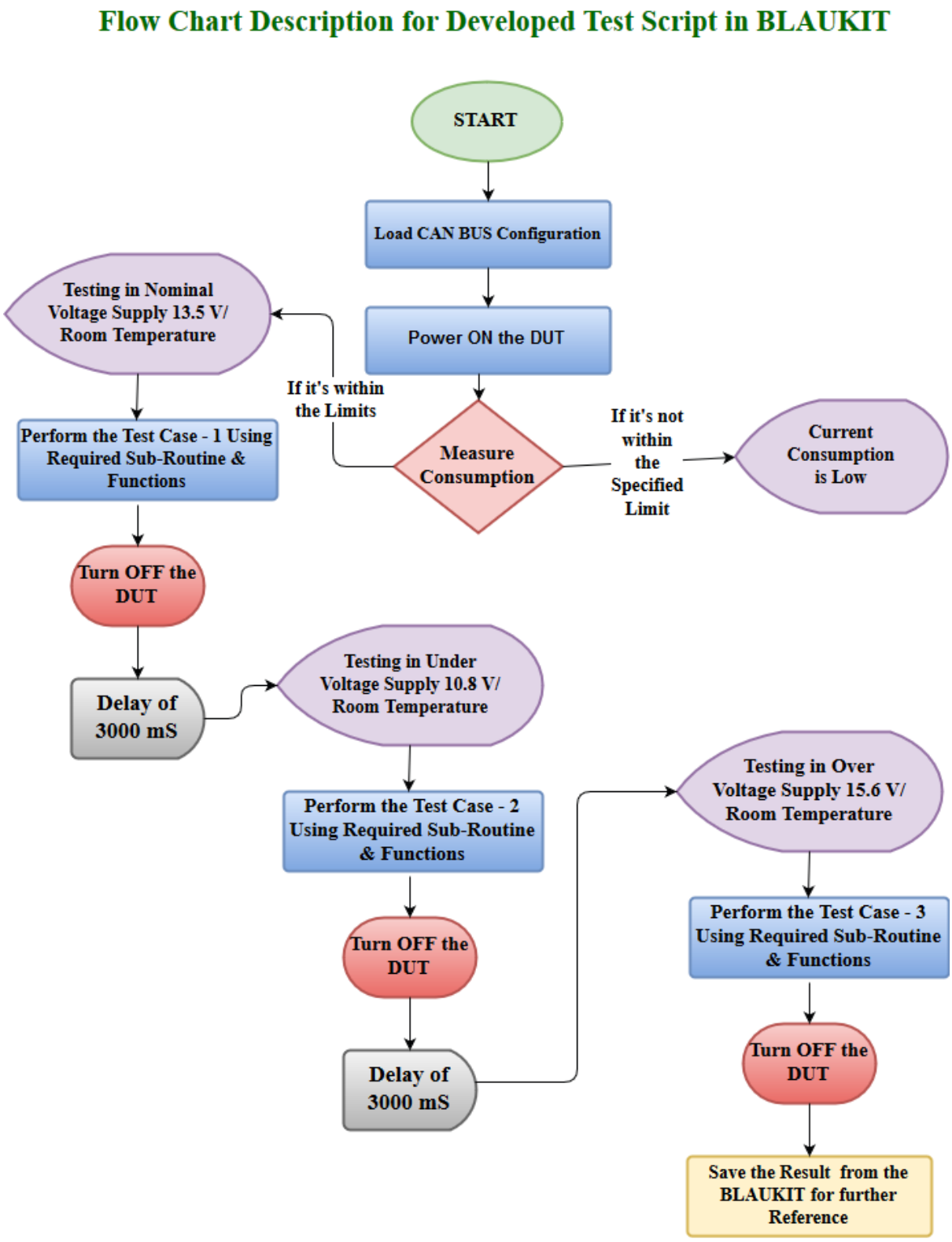


Figure 38 Flow Chart of Complete Test

Figure 39 is shows the flow chart description of test case 1 “Testing in Nominal Power Supply to the DUT”.

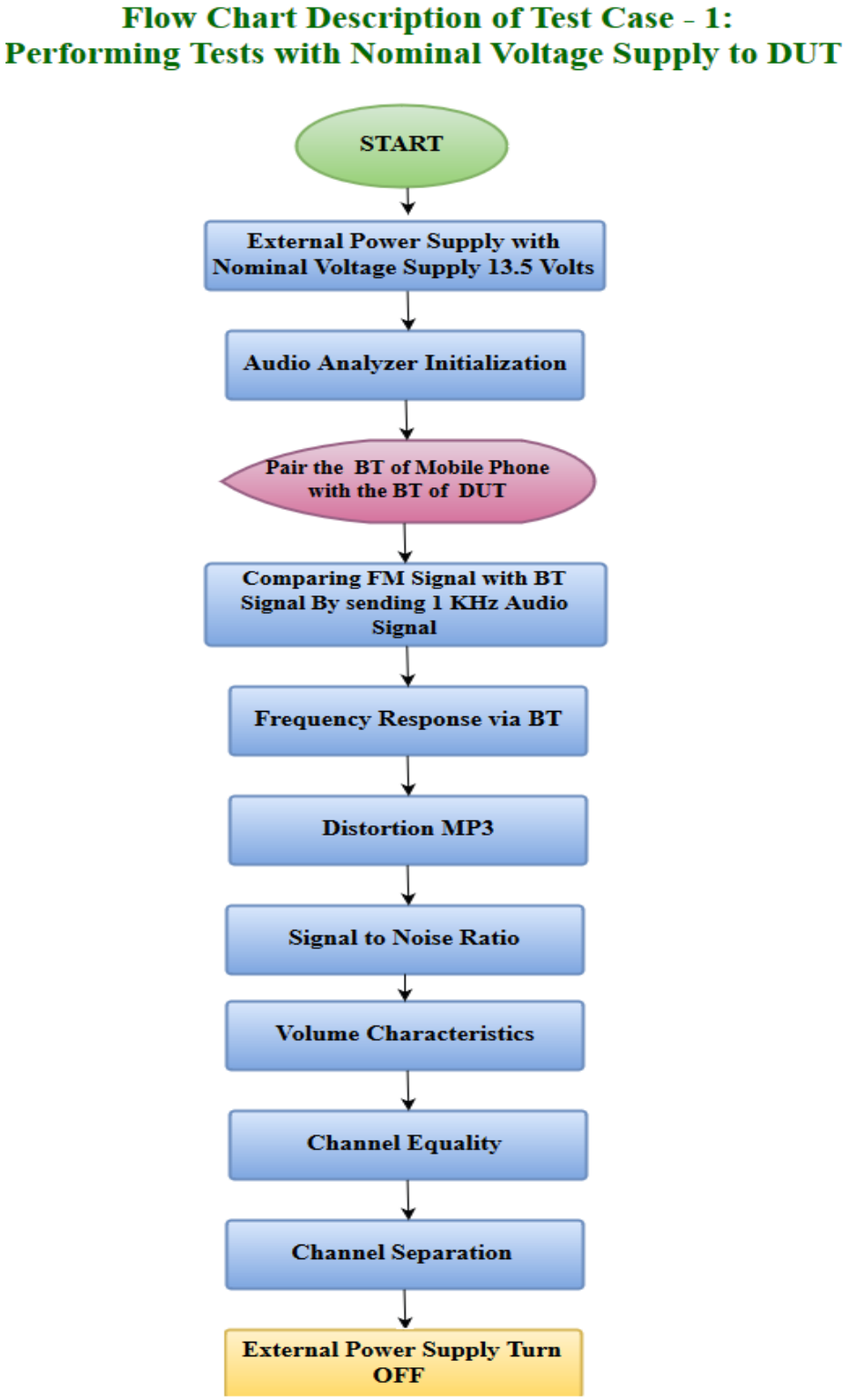


Figure 39 Flow Chart Description of Test Case – 1

Figure 40 shows the flowchart description of test cases 2 and 3, performing tests with under voltage supply to DUT and with over voltage supply to DUT respectively.

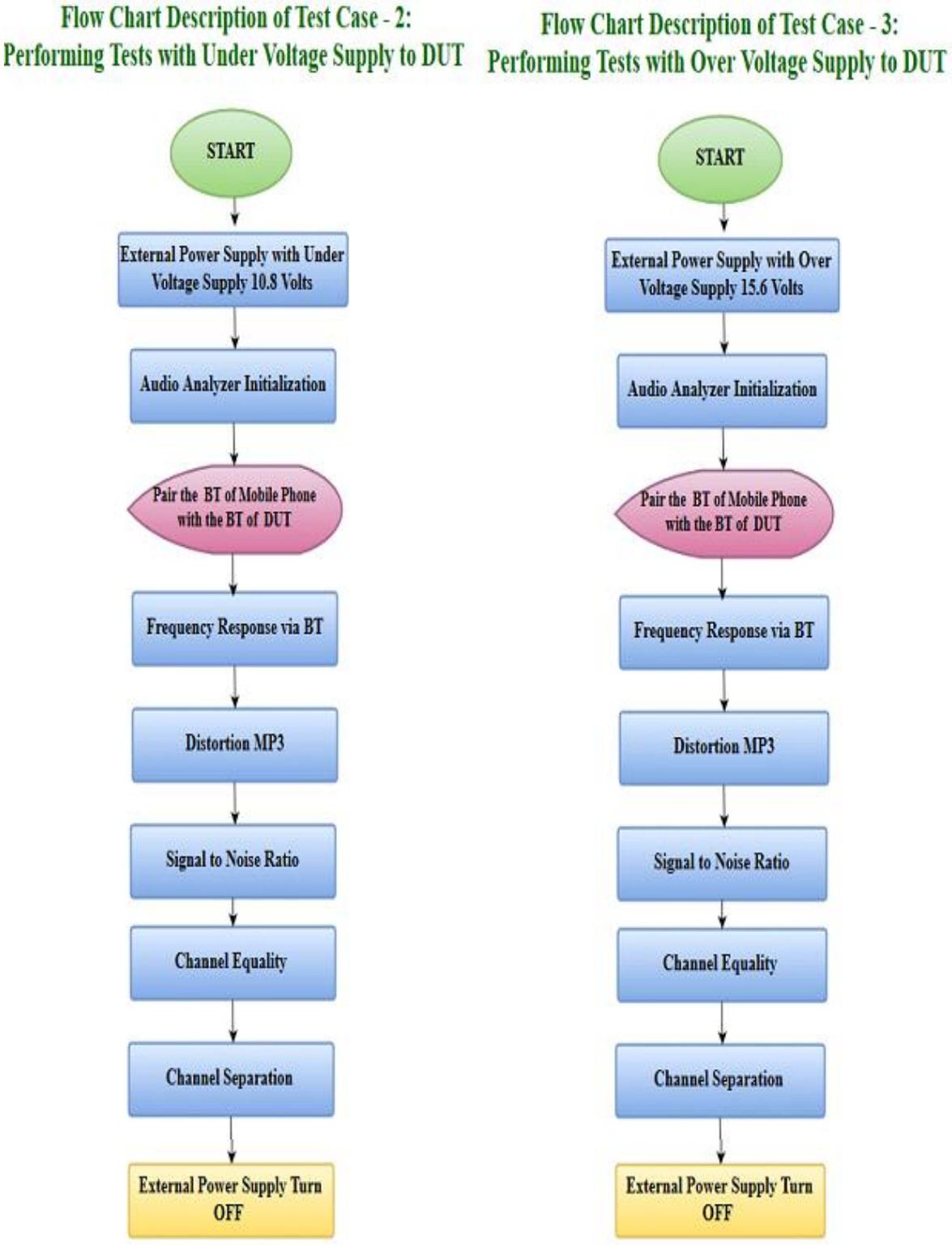


Figure 40 Flow Chart Description of Test Case 2 & 3

5. TEST SYSTEM RESULTS AND ITS SNAPS

This chapter elaborates the obtained results from the implemented blk scripts presenting measured values for the individual tests and snaps of the implemented test system.

5.1 Results Obtained

BLAUKIT results aggregated as in an excel document. Figure 41 shows the screenshot of the obtained results. For more details, refer to the attached document with the name of "17-Unit1_ResultList.xlsx".

BlauKit Report — BOSCH

StepID	Step Description	Expression	Evaluation Result	Unit	Lower Lim	Upper Lim	Ok	Time	SrcL	Seq
BlauKit:5.9.13; ActiveX:5.687; User:MIA1BRG; Host:PT-D0122; Temperature:Ambient Department:BrgP/ENG-PVT; Date:06/06/2017										
		"Power ON"	Power ON					14:30:35:105 S	57	0
		Consumption	797.214246	mA	700	900	Ok	14:30:40:175 N	1268	1
		"Testing in Nominal Votage V = 13.5V/Room Temperature"	Testing in Nominal Votage V = 13.5V/Room Temperature					14:30:40:175 S	1278	2
		"Audio Analyzer Initialization"	Audio Analyzer Initialization					14:30:40:185 S	100	3
		"TEST - 1 Comparing FM with BT by Sending 1KHz Signal"	TEST - 1 Comparing FM with BT by Sending 1KHz Signal					14:31:45:390 S	242	4
		"Step_2 Configuration in Signal Generator"	Step_2 Configuration in Signal Generator					14:31:49:060 S	259	5
		"Signal Genertator Initialization"	Signal Genertator Initialization					14:31:49:070 S	81	6
		"Signal Genertator Frequency Configuration"	Signal Genertator Frequency Configuration					14:31:49:080 S	85	7
		"Signal Genertator Level Configuration"	Signal Genertator Level Configuration					14:31:49:080 S	87	8
		"Signal Genertator Audio Frequency Configuration"	Signal Genertator Audio Frequency Configuration					14:31:49:090 S	90	9
		"Signal Genertator Modulation Tyep Configuration"	Signal Genertator Modulation Tyep Configuration					14:31:49:100 S	92	10
		"Step_3 Measurement in Signal Generator"	Step_3 Measurement in Signal Generator					14:31:49:110 S	261	11
		"Measuremnet in FM Signal"	Measuremnet in FM Signal					14:32:05:411 S	268	12
	Channel Left	AudioAnalyzerL	-11.03	dB	-12	-8	Ok	14:32:05:431 N	273	13
	Channel Rigth	AudioAnalyzerR	-11.55	dB	-12	-8	Ok	14:32:05:451 N	278	14
		"Measuremnet in BT Signal"	Measuremnet in BT Signal					14:32:08:242 S	282	15
	Channel Left	AudioAnalyzerL	-0.055	dB	-0.8	0.6	Ok	14:32:09:452 N	288	16
	Channel Right	AudioAnalyzerR	-0.561	dB	-0.9	0.6	Ok	14:32:09:472 N	294	17
		"Audio Analyzer RMS Configuration"	Audio Analyzer RMS Configuration					14:32:09:472 S	113	18
		"TEST - 2 Frequency Via BT"	TEST - 2 Frequency Via BT					14:32:09:762 S	301	19
		"Step_1 Low Frequency Audio Signal - 17Hz"	Step_1 Low Frequency Audio Signal - 17Hz					14:32:11:902 S	309	20
	Channel Left	AudioAnalyzerL	2.5567	dB	-3	3	Ok	14:32:21:163 N	317	21
	Channel Rigth	AudioAnalyzerR	2.0477	dB	-3	3	Ok	14:32:21:173 N	322	22
		"Step_2 High Frequency Audio Signal - 19.99kHz"	Step_2 High Frequency Audio Signal - 19.99kHz					14:32:21:183 S	323	23
	Channel Left	AudioAnalyzerL	-0.288	dB	-3	3	Ok	14:32:26:523 N	331	24
	Channel Rigth	AudioAnalyzerR	-0.836	dB	-3	3	Ok	14:32:26:543 N	336	25
		"Audio Analyzer Distortion Configuration"	Audio Analyzer Distortion Configuration					14:32:26:553 S	120	26
		"TEST -3 Distortion MP3"	TEST -3 Distortion MP3					14:32:27:403 S	343	27
	Channel Left	AudioAnalyzerL	0.0835	%	0	0.1	Ok	14:32:31:013 N	351	28
	Channel Rigth	AudioAnalyzerR	0.084	%	0	0.1	Ok	14:32:31:033 N	356	29

Figure 41 Displayed Result in BLAUKIT - Screenshot

The script was tested in two different units of "NISSAN A IVI SCOPE_1" product to check the stability of the blk programming scripts. In the resulting report, the measured values were compared with the mentioned lower and upper limits of the particular measurement and if they are within the limits, an "OK" is displayed. BLK. script was executed for various times to validate the accuracy and stability of the script.

5.1.1 Results for Different Units of NISSAN Product

The developed test script in the BLAUKIT was tested with the different units of the "NISSAN A IVI SCOPE_1" product to confirm the stability & accuracy of the developed test script. Test script was tested with the three different units of the NISSAN product. Test results for the three units are attached. Test results for all the three units are the same, units

are in the good status. For more details, refer the attachments “ATTACHMENT_No.4”, “ATTACHMENT_No.5” and “ATTACHMENT_No.6” excel file.

According to the test results, in all the three units there’s no abnormalities were found. Therefore, the implemented test system is working perfectly with zero percent error.

5.2 Snaps of the Implemented Test System

Equipment and computer were fixed in a movable rack. The test system’s snaps are shown in the following figures.

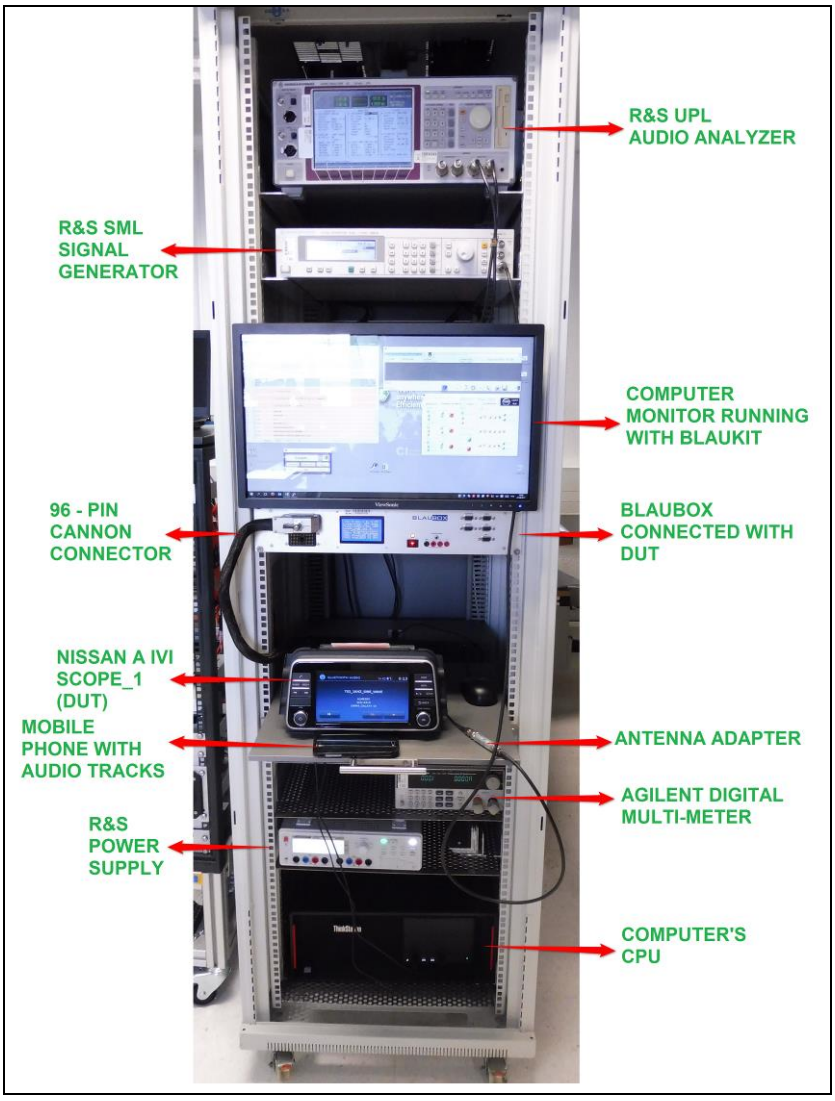


Figure 42 Implemented Test System

Figure 42 Implemented test system to test the audio signals of the Bluetooth modules.

Figure 43 Snap of Audio Analyzer & signal Generator

Figure 43 Rohde & Schwarz UPL – Audio Analyzer and the Rohde & Schwarz SML – Signal Generator.

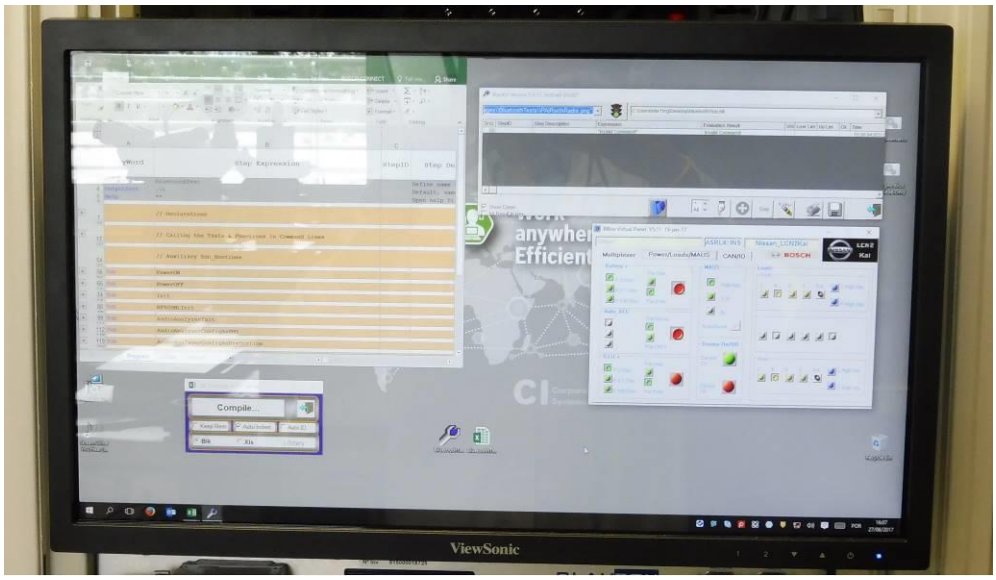


Figure 44 Snap of the Computer's Monitor

Figure 44 BLAUKIT application.

Figure 45 Snap of the Connection Between the BLAUBOX & DUT

Figure 45 presents the connection between the BLAUBOX and the DUT. Both of them are connected by the 96 PIN CANNON connector cable.

Figure 46 Snap of the Multi-Meter & Power Supply

Figure 46 shows the multi-meter and Rohde & Schwarz Programmable Power Supply.

5.3 Benefits of the Proposed Methodology

The benefits of the proposed system are as follows,

- Enables implementing Bluetooth Audio tests automatically.

- Reduces the human interfaces, reducing the risk of human errors in the test cases. It enables also having low level technicians instead of experienced engineers performing the tests.
- Can be put available to all the Quality Engineers in the QMM-FA to test the Bluetooth Audio easily.
- Speeds up the measurements the time duration around 8 minutes.
- Blk. scripts could be easily modified for other products and other modules of the product.

The main beneficial functionalities of the test Script are,

- Configuration of the equipment with pre-defined values for each tests and acquisition of measurements from all the equipment remotely
- After configuration, while performing tests need to acquire measurements from all the equipment remotely
- Control the DUT remotely

6. CONCLUSIONS

This chapter presents the limitations of the proposed test system and suggestions for the future work.

6.1 Limitations of the Proposed Methodology

The limitation of the developed test system are as follows:

- Time duration of the test is high in case of faulty DUTs.
- The main intention of the test system is to perform the Bluetooth audio tests fully automatically. However, the current version some human intervention is still required to send the preferred audio track to the tests system via paired mobile phone with the DUT.
- During, the test in order to play audio tracks, the mobile phone is used. It may introduce some distortions in to the test communications.

6.2 Suggestions for Future Work

The suggestions for the future work in the developed system are as follows,

- Include Bluetooth Protocols testing and measurement of the parameters of the Bluetooth module for e.g. transfer rate, communication distance, etc.,
- Extend the test procedure for other modules of the product like Wi-Fi module, Navigation System, GPS, FM, AM, etc.
- Use a USB Bluetooth pen instead of a mobile phone to send the audio tracks in order to eliminate the distortion issues. If the USB Bluetooth pens are used in the test system, it could be possible to control and command USB Bluetooth Pen to send the particular audio tracks via application software.
- Test system could be implemented for other products of BrgP by slightly changing the controlling parameters of the DUT (Car Radios).

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8. APPENDIX

ATTACHMENT NO.1 – “DEVELOPED TEST PLAN”

ATTACHMENT NO.2 – “BLK PROGRAM STRUCTURE”

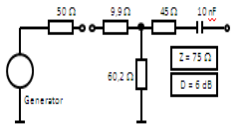
ATTACHMENT NO.3 – “DEVELOPED BLUETOOTH TEST SCRIPT”

ATTACHMENT NO.4 – “OBTAINED BLUETOOTH TEST RESULTS FOR UNIT_1”

ATTACHMENT NO.5 – “OBTAINED BLUETOOTH TEST RESULTS FOR UNIT_2”

ATTACHMENT NO.6 – “OBTAINED BLUETOOTH TEST RESULTS FOR UNIT_3”

ATTACHMENT NO.1 – "DEVELOPED TEST PLAN"

TESTS	Tests: Point	Tests: Specification	Tests: Reference	Measuring procedure	Testing parameters	Limits/Evaluation criterion: Setup	Condition 1 - Signal Generator	Condition 2 - Audio Analyser UPL	Condition 3 - DUT	Min.	Nominal	Max.	Unit	Description - NISSAN SCOPE_1 / Result	Results Evaluation: Good	Results Evaluation: Bad	Remarks/ Attachments
														Model: 7 503 750 801; Model Name: NISSAN A IVI SCOPE_1; HW version: 8; SW version: 0052 - 0155_170120; Mech. Status			
All the Tests are done in the Normal Room Temperature.																	
	Ref. to FEP Pt. 2	**28001NDS00[20] 28001NDS04[3]**	1.5 2.1.1	**Voltage Supply** Testing voltage: 13.5 V ±0.5 V, Terminal voltage at the device Operating voltage range: 10.8V to 15.6 V Reference output power 0.5 W at a load simulation of 4 Ω		13.5 ±0.5 10.8 - 15.6 0,50	**For Tests 1 to 6 Source Voltage is Keep as 13.50V & Output Power is same for all the Tests**										
1		**Internal test**	BPV	**Comparing FM Signal & Bluetooth Signal by Sending 1 KHz Audio Signal** In DUT, Put Radio in FM and check the FM frequency The pointer should be stop in 95.3MHz – Specified value in SG.	**04**	Play: F1_320KBPS_T02_1 KHz_SINE_WAVE.mp 3	**Special requirements on FM range**  Measurements with 75Ω dummy antenna Front-end tuner fn = 98 Mhz Modulation Δf = ± 22.5 kHz, f = 1 kHz E´ = 55 dB PAF = 0.5W / 4 Ω Comment for all FM measurements: The in 28001NDS00 mentioned generator level is referring to the open output level of the generator (EMF mode). This means that the display shows a 6dB higher value in EMF mode than in the "normal" mode (referring to a 50 Ohm)	Function: RMS & S/N REFERENCE VALUE: Store CH1 Value	Adjust the volume to set UPL Channel Values as, set to: (It should be more or less equal to 1.40V) & Volume keep as Constant	**FM SIGNAL MEASUREMENT** -8,00 Should be in this Range -12,00 dBr **BT SIGNAL MEASUREMENT** -0,8 CH 1 0,6 dBr -0,9 CH 2 0,6 dBr				CH1: -10.43 dBr CH2: -10.95 dBr CH1: 0.014 dBr CH2: 0.416 dBr	**Good**	**OK**
							S.No. / Variable / Value 1. Frequency: 95.30 MHz or 98 MHz (Front End Tuner) 2. Modulation: FM 3. Level: 52.0dBµV 4. FM Deviation: 22.500KHz 5. FM Source: LF Generator 6. EXT Coupling: AC 7. LF GEN Freq.: 1.000KHz 8. FM Bandwidth: Standard 9. FM Offset										
2	**307**	**28001NDS00[20]**	2.7.1	**Frequency response via BT** **STEP:1 Low Frequency Audio Signal - 17Hz** **Ref: 1 kHz Reference Audio Signal** **STEP:2 High Frequency Audio Signal - 19.99KHz**	**4**	F1_320KPBS => T03_17Hz_SINE_WAVE.mp3 STEP:2 F1_320KPBS => T07_19.99KHz_SINE_WAVE.mp3	Maintains the Same Maintains the Same	Filter: HP_22.0Hz should be in OFF Filter: HP_22.0Hz should be in OFF	Volume Keep as Constant Volume Keep as Constant	REF: -3,00 0.00 3,00 dB -3,00 0.00 3,00 dB -3,00 0.00 3,00 dB -3,00 0.00 3,00 dB				CH1: 3.017 dBr with 17.01Hz CH2: 2.447 dBr with 16.99 Hz CH1: 0.0045 dBr with 19.99 KHz CH2: -0.6125 dBr with 19.98 KHz	**Good** **Good**	**OK** **OK**
3	**308**	**Internal test**	BPV	**Distorsion MP3** Distortion Ratio (THD + N)	**02**	F1_320KPBS => T02_1KHz_SINE_WAVE.mp3	Maintains the Same	Function: [THD + N] THD/SINAD Filter: HP_22Hz in ON Filter: LP_20KHz in ON	Keep the volume of DUT as Constant.			<= 0,1	%	CH 1: 0.0385 % with 1 KHz CH 2: 0.03785 % with 1 KHz	**Good**	**OK**
4	**309**	**Internal test**	BPV	**Signal-to-noise ratio (MP3 (192 kbps, 44,1 kHz))** **1kHz/0dBSignal with Signal** Without Signal	**02**	F1_320KPBS => T02_1KHz_SINE_WAVE.mp3 F1_320KPBS=> T08 Infinity Zero.mp3	Maintains the Same Maintains the Same	Function: RMS & S/N Filter: HP_22Hz in ON Filter: LP_20KHz in ON Ensure the reference value is with Signal Va = 1.40V	Keep the volume of DUT as Constant.	Difference Between the reference signal and measured noise 70,00 dB				Reference Signal CH1: 0.0053 dBr CH2: -0.6930 dBr Measured Noise CH1: -79.15 dBr CH2: -79.41 dBr **SNR = Ref. Signal Value - Measure Noise** CH1: 79.155 dBr CH2: 78.71 dBr	**Good**	**OK**

5	**210**	**28001NDS04[03] TS-47.04**	2.2.4 8.1.4.1.3.11 Spec. 16394	**Volume characteristics** System amplification (Reference): Ua = 2.0V @ CD 1kHz, -20dB, Volume max.	**42**	F1_320KPBS => T16_1KHz_SINE_WAVE.mp3	Maintains the Same	Function: RMS & S/N Filter: CCIR_Unwtd in ON Filter: LP_20KHz in OFF REFERENCE VALUE: Store CH1 Value	All over the steps need to increase the volume of DUT by one step, from Step 1 until 40 Step 0 is mute.	**Volume Characteristics**				CH1:	CH2:		
				Volume step													
				0 Mute	**01**					-83	± 1		dB	-83,33	-83,34	**Good**	**OK**
				1 '-79	**02**					-79	± 1		dB	-78,82	-79,19	**Good**	**OK**
				2 '-71	**03**					-71	± 1		dB	-71,46	-71,74	**Good**	**OK**
				3 '-63	**04**					-63	± 1		dB	-63,51	-63,9	**Good**	**OK**
				4 '-57	**05**					-57	± 1		dB	-57,5	-57,92	**Good**	**OK**
				5 '-53	**06**					-53	± 1		dB	-53,5	-53,9	**Good**	**OK**
				6 '-50	**07**					-50	± 1		dB	-50,49	-50,87	**Good**	**OK**
				7 '-47	**08**					-47	± 1		dB	-47,49	-47,86	**Good**	**OK**
				8 '-45	**09**					-45	± 1		dB	-45,4	-45,85	**Good**	**OK**
				9 '-43	**10**					-43	± 1		dB	-43,43	-43,85	**Good**	**OK**
				10 '-41	**11**					-41	± 1		dB	-41,45	-41,85	**Good**	**OK**
				11 '-39	**12**					-39	± 1		dB	-39,45	-39,88	**Good**	**OK**
				12 '-37	**13**					-37	± 1		dB	-37,45	-37,82	**Good**	**OK**
				13 '-35	**14**					-35	± 1		dB	-35,45	-35,82	**Good**	**OK**
				14 '-34	**15**					-34	± 1		dB	-34,44	-34,81	**Good**	**OK**
				15 '-32	**16**					-32	± 1		dB	-32,41	32,81	**Good**	**OK**
				16 '-31	**17**					-31	± 1		dB	-31,44	-31,85	**Good**	**OK**
				17 '-30	**18**					-30	± 1		dB	-30,44	-30,85	**Good**	**OK**
				18 '-29	**19**					-29	± 1		dB	-29,44	-27,42	**Good**	**OK**
				19 '-27	**20**					-27	± 1		dB	-27,42	-27,88	**Good**	**OK**
				20 '-26	**21**					-26	± 1		dB	-26,42	-26,85	**Good**	**OK**
				21 '-25	**22**					-25	± 1		dB	-25,42	-25,8	**Good**	**OK**
				22 '-23	**23**					-23	± 1		dB	-23,42	-23,81	**Good**	**OK**
				23 '-22	**24**					-22	± 1		dB	-22,42	-22,82	**Good**	**OK**
				24 '-21	**25**					-21	± 1		dB	-21,4	-21,8	**Good**	**OK**
				25 '-19	**26**					-19	± 1		dB	-19,42	-19,78	**Good**	**OK**
				26 '-18	**27**					-18	± 1		dB	-18,42	-18,82	**Good**	**OK**
				27 '-17	**28**					-17	± 1		dB	-17,42	-17,78	**Good**	**OK**
				28 '-15	**29**					-15	± 1		dB	-15,42	-15,78	**Good**	**OK**
				29 '-14	**30**					-14	± 1		dB	-14,42	-14,78	**Good**	**OK**
				30 '-13	**31**					-13	± 1		dB	-13,42	-13,79	**Good**	**OK**
				31 '-12	**32**					-12	± 1		dB	-12,42	-12,78	**Good**	**OK**
				32 '-10	**33**					-10	± 1		dB	-10,42	-10,78	**Good**	**OK**
				33 '-9	**34**					-9	± 1		dB	-9,42	-9,78	**Good**	**OK**
				34 '-8	**35**					-8	± 1		dB	-8,44	-8,78	**Good**	**OK**
				35 '-6	**36**					-6	± 1		dB	-5,96	-6,32	**Good**	**OK**
				36 '-5	**37**					-5	± 1		dB	-4,91	-5,2	**Good**	**OK**
				37 '-4	**38**					-4	± 1		dB	-3,97	-4,32	**Good**	**OK**
				38 '-2	**39**					-2	± 1		dB	-2,35	-2,7	**Good**	**OK**
				39 '-1	**40**					-1	± 1		dB	-1,19	-1,56	**Good**	**OK**
				40 '0	**41**					0	± 1		dB	0,01	-0,39	**Good**	**OK**
6		**50150**	PAV	**Channel Equality LF Ref.**	**04**	F1_320KPBS => T02_1KHz_SINE_WAVE.mp3	Maintains the Same	Function: RMS & S/N Filter: HP_22Hz in ON Filter: LP_20KHz in ON Ensure the reference value is with Signal Va = 1.40V		Difference Between the Channels							
				Step 1: In Loads Front : LF & RF					Measure Channel Values in Loads Front	-1		1	dB	CH1: 0.0504 dBr	CH2: -0.5809 dBr		
														Difference LF & RF: 0.6318 dBr		**Good**	**OK**
				Step 2: In Loads Rear: LR & RR					Measure Channel Values in Loads Rear	-1		1	dB	CH1:-0.1180 dBr	CH2: -0.0781 dBr		
														Difference LR & RR: -0.04 dBr		**Good**	**OK**
7		**Internal test**		**Channel Speration**						-0,5	CH 1	0,5	dB				
				STEP 1: Signal in Left Channel	**02**	Play: F1_320KPBS => T09_1KHz_SINE_WAVE.mp3	Maintains the Same	Function: RMS & S/N Filter: HP_22Hz in ON Filter: LP_20KHz in ON In CH1, 1.40V keep as Reference.	Keep the volume of DUT as Constant.	-80	CH 2	-70	dB	CH 1: -0.003 dBr with 1 KHz	CH2 2: -76.48 dBr with No	**Good**	**OK**
				STEP 2 Signal in Right Channel	**02**	F1_320KPBS => T11_1KHz_SINE_WAVE.mp3	Maintains the Same	Function: RMS & S/N Filter: HP_22Hz in ON Filter: LP_20KHz in ON In CH2, 1.40V keep as Reference.	Keep the volume of DUT as Constant.	-80	CH 1	-70	dB	CH 1: -72.46 dBr with No	CH2 2: -0.002 dBr with 1 KHz	**Good**	**OK**
										-0,5	CH 2	0,5	dB				
Testing of Bluetooth Audio with different Source Voltage: Under Voltage																	
Source Voltage 10.8V/ Room Temperature																	
8	**307**	**28001NDS00[20]**	2.7.1	**Frequency response via BT** **STEP:1 Low Frequency Audio Signal - 17Hz** **1 kHz Reference Audio Signal**	**02**	F1_320KPBS => T03_17Hz_SINE_WAVE.mp3	Maintains the Same	Filter: HP_20.0Hz should be in OFF	Volume Keep as Constant	-3,00 -3,00	0.00 0.00 0.00	3,00 3.00	dB dB dB	CH1: 3.017 dBr with 17.01Hz	CH2: 2.447 dBr with 16.99 Hz	**Good**	**OK**
				STEP:2 High Frequency Audio Signal - 19.99KHz	**02**	STEP:2 F1_320KPBS => T07_19.99KHz_SINE	Maintains the Same	Filter: HP_20.0Hz should be in OFF	Volume Keep as Constant	-3,00 -3,00	0.00 0.00 0.00	3,00 3.00	dB dB dB	CH1: 0.0045 dBr with 19.99 KHz	CH2: -0.6125 dBr with 19.98 KHz	**Good**	**OK**

						WAVE.mp3								
9	308	Internal test	BPV	**Distorsion MP3** Distortion Ratio (THD + N)	02	F1_320KPBS => T02_1KHz_SINE_WAVE.mp3	Maintains the Same	Function: [THD + N] THD/SINAD Filter: HP_22Hz in ON Filter: LP_20KHz in ON	Keep the volume of DUT as Constant.	<= 0,1 %	CH 1: 0.0385 % with 1 KHz	CH 2: 0.03785 % with 1 KHz	**Good**	**OK**
10	309	Internal test	BPV	**Signal-to-noise ratio (MP3 (192 kbps, 44,1 kHz))** **1kHz/0dBSignal with Signal**	02	F1_320KPBS => T02_1KHz_SINE_WAVE.mp3	Maintains the Same	Function: RMS & S/N Filter: HP_22Hz in ON Filter: LP_20KHz in ON Ensure the reference value is with Signal Va = 1.40V	Keep the volume of DUT as Constant.	Difference Between the reference signal and measured noise -70,00 dB	Reference Signal CH1: 0.0053 dBr CH2: -0.6930 dBr	Measured Noise CH1: -79.15 dBr CH2: -79.41 dBr		
				Without Signal : Infinity Zero Signal		F1_320KPBS=> T08 Infinity Zero.mp3	Maintains the Same				**SNR = Ref. Signal Value - Measure Noise** CH1: 79.155 dBr	CH2: 78.71 dBr	**Good**	**OK**
11		50150	PAV	**Channel Equality LF Ref.** **Step 1: In Loads Front : LF & RF**	04	F1_320KPBS => T02_1KHz_SINE_WAVE.mp3	Maintains the Same	Function: RMS & S/N Filter: HP_22Hz in ON Filter: LP_20KHz in ON Ensure the reference value is with Signal Va = 1.40V	Measure Channel Values in Loads Front	Difference Between the Channels -1 1 dB	CH1: 0.0504 dBr	CH2: -0.5809 dBr		
											Difference LF & RF: 0.6318 dBr		**Good**	**OK**
				Step 2: In Loads Rear: LR & RR					Measure Channel Values in Loads Rear	-1 1 dB	CH1:-0.1180 dBr	CH2: -0.0781 dBr		
											Difference LR & RR: -0.04 dBr		**Good**	**OK**
12		Internal test		**Channel Speration** **STEP 1: Signal in Left Channel**	02	Play: F1_320KPBS => T09_1KHz_SINE_WAVE.mp3	Maintains the Same	Function: RMS & S/N Filter: HP_22Hz in ON Filter: LP_20KHz in ON In CH1, 1.40V keep as Reference.	Keep the volume of DUT as Constant.	-0,5 CH 1 0,5 dB -80 CH 2 -70 dB	CH 1: -0.003 dBr with 1 KHz	CH2 2: -76.48 dBr with No	**Good**	**OK**
				STEP 2 Signal in Right Channel	02	F1_320KPBS => T11_1KHz_SINE_WAVE.mp3	Maintains the Same	Function: RMS & S/N Filter: HP_22Hz in ON Filter: LP_20KHz in ON In CH2, 1.40V keep as Reference.		-80 CH 1 -70 dB -0,5 CH 2 0,5 dB	CH 1: -72.46 dBr with No	CH2 2: -0.002 dBr with 1 KHz	**Good**	**OK**
Testing of Bluetooth Audio with different Source Voltage: Over Voltage														
Source Voltage 15.6V/ Room Temperature														
13	307	28001NDS00[20]	2.7.1	**Frequency response via BT** **STEP:1 Low Frequency Audio Signal - 17Hz** **1 kHz Reference Audio Signal**	02	F1_320KPBS => T03_17Hz_SINE_WAVE.mp3	Maintains the Same	Filter: HP_20.0Hz should be in OFF	Volume Keep as Constant	-3,00 0,00 3,00 dB 0,00 dB -3,00 0,00 3,00 dB	CH1: 3.017 dBr with 17.01Hz	CH2: 2.447 dBr with 16.99 Hz	**Good**	**OK**
				STEP:2 High Frequency Audio Signal - 19.99KHz	02	STEP:2 F1_320KPBS => T07_19.99KHz_SINE_WAVE.mp3	Maintains the Same	Filter: HP_20.0Hz should be in OFF	Volume Keep as Constant	0,00 -3,00 3,00 dB 0,00 dB -3,00 0,00 3,00 dB	CH1: 0.0045 dBr with 19.99 KHz	CH2: -0.6125 dBr with 19.98 KHz	**Good**	**OK**
14	308	Internal test	BPV	**Distorsion MP3** Distortion Ratio (THD + N)	02	F1_320KPBS => T02_1KHz_SINE_WAVE.mp3	Maintains the Same	Function: [THD + N] THD/SINAD Filter: HP_22Hz in ON Filter: LP_20KHz in ON	Keep the volume of DUT as Constant.	<= 0,1 %	CH 1: 0.0385 % with 1 KHz	CH 2: 0.03785 % with 1 KHz	**Good**	**OK**
15	309	Internal test	BPV	**Signal-to-noise ratio (MP3 (192 kbps, 44,1 kHz))** **1kHz/0dBSignal with Signal**	02	F1_320KPBS => T02_1KHz_SINE_WAVE.mp3	Maintains the Same	Function: RMS & S/N Filter: HP_22Hz in ON Filter: LP_20KHz in ON Ensure the reference value is with Signal Va = 1.40V	Keep the volume of DUT as Constant.	Difference Between the reference signal and measured noise -70,00 dB	Reference Signal CH1: 0.0053 dBr CH2: -0.6930 dBr	Measured Noise CH1: -79.15 dBr CH2: -79.41 dBr		
				Without Signal : Infinity Zero Signal		F1_320KPBS=> T08 Infinity Zero.mp3	Maintains the Same				SNR = Ref. Signal Value - CH1: 79.155 dBr	CH2: 78.71 dBr	**Good**	**OK**
16		50150	PAV	**Channel Equality LF Ref.** **Step 1: In Loads Front : LF & RF**	04	F1_320KPBS => T02_1KHz_SINE_WAVE.mp3	Maintains the Same	Function: RMS & S/N Filter: HP_22Hz in ON Filter: LP_20KHz in ON Ensure the reference value is with Signal Va = 1.40V	Measure Channel Values in Loads Front	Difference Between the Channels -1 1 dB	CH1: 0.0504 dBr	CH2: -0.5809 dBr		
											Difference LF & RF: 0.6318 dBr		**Good**	**OK**
				Step 2: In Loads Rear: LR & RR					Measure Channel Values in Loads Rear	-1 1 dB	CH1:-0.1180 dBr	CH2: -0.0781 dBr		
											Difference LR & RR: -0.04 dBr		**Good**	**OK**

17		**Internal test**		**Channel Speration**							-0,5	CH 1	0,5	dB				
				STEP 1: Signal in Left Channel	**02**	Play: F1_320KPBS => T09_1KHz_SINE_WAVE.mp3	Maintains the Same	Function: RMS & S/N Filter: HP_22Hz in ON Filter: LP_20KHz in ON In CH1, 1.40V keep as Reference.	Keep the volume of DUT as Constant.	-80	CH 2	-70	dB	CH 1: -0.003 dBr with 1 KHz	CH2 2: -76.48 dBr with No	**Good**	**OK**
				STEP 2 Signal in Right Channel	**02**	F1_320KPBS => T11_1KHz_SINE_WAVE.mp3	Maintains the Same	Function: RMS & S/N Filter: HP_22Hz in ON Filter: LP_20KHz in ON In CH2, 1.40V keep as Reference.	Keep the volume of DUT as Constant.	-80	CH 1	-70	dB	CH 1: -72.46 dBr with No	CH2 2: -0.002 dBr with 1 KHz	**Good**	**OK**
										-0,5	CH 2	0,5	dB				

Help	//"helpFile.mht"		Open help file				n				
	//Variable declarations		Define all variables				n				
Extern	String BarCode, StrTypeNumber, StrSerialNumber						n				
Extern	Number DB_Power_V, DB_Power_UV, DB_Power_OV, DB_Volume_steps, DB_Ref_AF, DB_FM_Start_freq, DB_FM_Ref_freq, DB_FM_End_freq, DB_MW_Start_freq, DB_MW_Ref_freq, DB_MW_End_freq, DB_LW_Start_freq, DB_LW_Ref_freq, DB_LW_End_freq, DB_KW_Start_freq, DB_KW_Ref_freq, DB_KW_End_freq, DB_TunerType, DB_Align_freq_1, DB_Align_freq_2, DB_Align_level, DB_FM_calib_level, DB_MW_calib_level, DB_LW_calib_level,DB_KW_calib_level, DB_FM_Sens_level, DB_MW_Sens_level, DB_LW_Sens_level,DB_KW_Sens_level, UsingKeyBoardBarCodeReader, DB_StepDelay, VPower		For further use of numeric variables from data base				n				
Extern	String DB_Family_name, DB_Device_Name, DB_Device_Photo, DB_OutputPath, DB_Sw_download_file, DB_Fascia_TypeNr, DB_Aux01, DB_Aux02, DB_Aux03, DB_Aux04, DB_Aux05, DB_Aux06, DB_Aux07, DB_Aux08, DB_Aux09, DB_Aux10, Str_DB_LastChangeDate, Str_Aux_StepDelay, DB_IDB_TYPE, BlauKitBlkCommandLine, DB_TEST_MATRIX, LastStrTypeNumber		For further use of string variables from data base				n				
Extern	String Align_ProgramTitle, BlauKitBlkCommandLine, STR_PROTOCOL						n				
Local	Number NunAuxLocalCounter						n				
Local	Number NunAuxLocalIndex						n				
Local	String StrAuxLocal						n				
	//Program Structure		Define all program steps				n				
OnError	ErrorHandler						n				
Call	Init		Init				n				
Call	ReadBarCode		ReadBarCode				n				
Call	ReadDataBase		ReadDataBase				n				
Call	Main		Main				n				
End	**//End Program**						n				
Sub	**Main**		Main program				n				
							n				
							n				
							n				
							n				
							n				
							n				
							n				
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							n				
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							n				
							n				
							n				
							n				

							n			
							n			
							n			
							n			
EndSub	**//End Main**						n			
Sub	**ReadBarCode**						n			
Run	"ReadBarCode.blk"		BarCode				n			
If	Len(BarCode) == 0//cancel pressed						n			
End	"Operation was canceled!"						y			
EndIf							n			
EndSub	**//End ReadBarCode**						n			
Sub	**ReadDataBase**						n			
	Dll("ReadCsv.dll", "ReadAllFieldsToSameVariableName", DEVICE_DATA_BASE + ";" + StrTypeNumber + ";" + StrSerialNumber)		Read all vars from data base				n			
If	Option_DataBase_Date_Check == TRUE	DataBase_Date_Check					n			
If	Len(Str_DB_LastChangeDate) == 0						n			
End	MsgBox("DB date is missing in DEVICE_DATA_BASE", Align_ProgramTitle, MB_OK | MB_ICONEXCLAMATION | MB_PICTURE_RESIZE, Picnok)		Missing record date				y			
Else							n			
	CurrentDay = (Atof(Now("%Y"))-1)*365+(Atof(Now("%m"))-1)*30+Atof(Now("%d"))						n			
	DataReccordDay = (Atof(Mid(Str_DB_LastChangeDate,6))-1)*365+(Atof(Mid(Str_DB_LastChangeDate,3,2))-1)*30+Atof(Mid(Str_DB_LastChangeDate,0,2))		IDB_DATA_BASE DataReccordDay				n			
If	(CurrentDay - DataReccordDay) > 60		Warning due to old reccord				n			
If	MsgBox(Format("DB date reccord is %.0f days old!\nDo you want to comtinue?", CurrentDay - DataReccordDay), Align_ProgramTitle, MB_YESNO | MB_ICONEXCLAMATION | MB_PICTURE_RESIZE, Picwarn) == IDNO						n			
End	"Old reccord date. Operation was canceled"						y			
EndIf							n			
EndIf							n			
EndIf							n			
EndIf							n			
	DB_Device_Name	DB_Device_Name	Device Name				y			
EndSub	**//End ReadDataBase**						n			
Sub	**Init**						n			
	//BlauKitBlkCommandLine						n			
	BlauKitBlkCommandLine = Lcase(BlauKitBlkCommandLine - " ")		Pass all command line to lower case				n			

	BlauKitOutOfLimitsErrorCounter = 0		Reset Error Counter				n			
	BlauKitReportTitleSettingsInfo = Align_ProgramTitle		Settings to be printed on the report				n			
If	About() < 5.2		Check Version				n			
End	MsgBox("This program requires ActiveX V5.2 or Higher!", Align_ProgramTitle, MB_OK | MB_ICONEXCLAMATION | MB_PICTURE_RESIZE, Picnok)		Invalid version				y			
EndIf							n			
EndSub	//End Init						n			
Sub	ErrorHandler		On error message				n			
	MsgBox("Error!", Align_ProgramTitle, MB_OK | MB_ICONEXCLAMATION | MB_PICTURE_RESIZE, Picnok)						y			
End							n			
EndSub	//End ErrorHandler						n			

Help	""		Open help file				n			
	// Declarations						n			
Extern	String BlauKitBlkCommandLine						n			
Local	String AudioAnalyzerResult						n			
Local	Number AudioAnalyzerL, AudioAnalyzerR						n			
Decl	Number AudioAnalyzerMeasure(Number Channel, Number nMeasures)						n			
Decl	Number AudioAnalyzerWaitForMeasurementValue(Number Channel, Number LimitMin, Number LimitMax, Number TimeOut)						n			
Decl	Number WaitForMeasurementValue(String MeasDevice, Number LimMin, Number LimMax, Number TimeOut)						n			
Decl	Number AudioAnalyzerMeasureEx(Number Channel, Number LimitMin, Number LimitMax, Number nMeasures, Number TimeOut)						n			
Decl	Number VolumeControlByVoltageLevel(Number Channel, Number LimitMin, Number LimitMax, Number TimeOut)						n			
	// Calling the Tests & Functions in Command Line of BLAUKIT									
Call	Init									
Call	BlauBoxInit									
If	BlauKitBlkCommandLine == "/poweron"									
Call	ExternalPowerSupplyNominalVoltage									
Call	PowerON									
Call	MeasureConsumption									
ElseIf	BlauKitBlkCommandLine == "/poweroff"									
Call	PowerOFF									
Call	ExternalPowerSupplyOff									
ElseIf	BlauKitBlkCommandLine == "/rfgeninit"									
Call	RFSGSMLInit									
ElseIf	BlauKitBlkCommandLine == "/analyzerconfig"									
Call	AudioAnalyzerInit									
ElseIf	BlauKitBlkCommandLine == "/analyzerconfigrms"									
Call	AudioAnalyzerConfigAsRMS									
ElseIf	BlauKitBlkCommandLine == "/freqresponse"									
Call	FrequencyResponseViaBT									
ElseIf	BlauKitBlkCommandLine == "/comparingfmwithbt"									
Call	ComparingFMwithBT									
ElseIf	BlauKitBlkCommandLine == "/distortion"									
Call	DistortionMP3									

ElseIf	BlauKitBlkCommandLine == "/signaltonoise"									
Call	SignalToNoiseRatio									
ElseIf	BlauKitBlkCommandLine == "/channelseperation"									
Call	ChannelSeperation									
ElseIf	BlauKitBlkCommandLine == "/volumecharac"									
Call	VolumeCharacteristics									
ElseIf	BlauKitBlkCommandLine == "/chanequality"									
Call	ChannelEquality									
ElseIf	BlauKitBlkCommandLine == "/completetest"									
Call	CompleteTest									
Else										
End	"Invalid Command!"							y		
EndIf										
End										
	// Auxiliary Sub_Routines									
Sub	**PowerON**							n		
	"Power ON"							y		
	VisaWrite("Interface", "Power:1:Extern")							n		
	VisaWrite("Interface", "Power:2:Intern")							n		
	VisaWrite("Interface", "Power:1:ON")							n		
	VisaWrite("Interface", "AUX:4:12V")							n		
	VisaWrite("Interface", "Power:2:ON")							n		
	VisaWrite("Interface", "AUX:1:12V")							n		
EndSub								n		
Sub	**PowerOFF**							n		
	"Power OFF"							y		
	VisaWrite("Interface", "Power:2:OFF")							n		
	VisaWrite("Interface", "Power:1:OFF")							n		
	VisaWrite("Interface", "AUX:4:OFF")							n		
	VisaWrite("Interface", "AUX:1:OFF")							n		
EndSub								n		
Sub	**Init**							n		
	BlauKitBlkCommandLine = Lcase(BlauKitBlkCommandLine - " ")		Pass all command line to lower case					n		
	BlauKitOutOfLimitsErrorCounter = 0		Reset Error Counter					n		
	AutoClearOutputContents = 1							n		

EndSub							n			
Sub	**RFSGSMLInit**									
	"Signal Genertator Initialization"						y			
	IbWrt(RFGEN, "FREQ 95.300MHz")						n			
	IbWrt(RFGEN, "POW 58.0dBuV")						n			
	IbWrt(RFGEN, "OUTP:STAT ON")						n			
	"Signal Genertator Frequency Configuration"						y			
	IbWrt(RFGEN, "FREQ %.3fMHz")						n			
	"Signal Genertator Level Configuration"						y			
	IbWrt(RFGEN, "POW %.1fdBuV")						n			
	IbWrt(RFGEN, "OUTP:STAT ON")						n			
	"Signal Genertator Audio Frequency Configuration"						y			
	IbWrt(RFGEN, "FM:INT:FREQ %.3fKHz")						n			
	"Signal Genertator Modulation Tyep Configuration"						y			
	IbWrt(RFGEN, "FM:STAT ON")						n			
	IbWrt(RFGEN, "AM:STAT OFF")						n			
	IbWrt(RFGEN, "FM %.3fKHZ")						n			
	IbWrt(RFGEN, "FM:SOUR INT")						n			
EndSub										
Sub	**AudioAnalyzerInit**						n			
	"Audio Analyzer Initialization"						y			
	IbWrt(AudioAnalyzer, "INST2 A22")						n			
	IbWrt(AudioAnalyzer, "SENS:POW:REF:RES 75")						n			
	IbWrt(AudioAnalyzer, "INP1:COUP AC")						n			
	IbWrt(AudioAnalyzer, "INP1:TYPE BAL")						n			
	IbWrt(AudioAnalyzer, "INP1:IMP R300")						n			
	IbWrt(AudioAnalyzer, "INP1:LOW FLO")						n			
	IbWrt(AudioAnalyzer, "INP:SEL CH1I")						n			
	IbWrt(AudioAnalyzer, "TRIG:SOUR CH1R")						n			
	IbWrt(AudioAnalyzer, "TRIG:SOUR CH2R")						n			
EndSub							n			
Sub	**AudioAnalyzerConfigAsRMS**						n			
	"Audio Analyzer RMS Configuration"						y			
	IbWrt(AudioAnalyzer, "sens:func 'RMS'")						n			
	IbWrt(AudioAnalyzer, "sens:filt1:ufil6 off")		HP22Hz OFF				n			
	IbWrt(AudioAnalyzer, "sens:filt2:ufil1 on")		LP20.kHz ON				n			
EndSub							n			

Sub	**AudioAnalyzerConfigAsDistortion**						n			
	"Audio Analyzer Distortion Configuration"						y			
	IbWrt(AudioAnalyzer, "sens:func 'THDN'")						n			
	IbWrt(AudioAnalyzer, "sens:filt1:ufil6 on")		HP22Hz ON				n			
	IbWrt(AudioAnalyzer, "sens:filt2:ufil1 on")		LP20.kHz ON				n			
EndSub							n			
Sub	**BlauBoxInit**									
	VisaWrite("Interface", "CH:OUT:ON")		Activate Outputs to Audio Analyzer							
	//VisaWrite("Interface", "CH:MULT:OUT:ON")		Activate Output to Extern Multimeter							
EndSub										
Func	**Number AudioAnalyzerMeasure(Number Channel, Number nMeasures)**						n			
Local	String AudioAnalyzerResult						n			
Local	Number AudioAnalyzerValue, AudioAnalyzerValueSum, MeasureCount						n			
	MeasureCount = 0						n			
	AudioAnalyzerValueSum = 0						n			
While	MeasureCount < nMeasures						n			
If	Channel == 1						n			
	IbWrt(AudioAnalyzer, "sens:data1?")						n			
Else							n			
	IbWrt(AudioAnalyzer, "sens:data2?")						n			
EndIf							n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	AudioAnalyzerValue = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerValueSum = AudioAnalyzerValueSum + AudioAnalyzerValue						n			
	MeasureCount++						n			
EndWhile							n			
Return	(AudioAnalyzerValueSum / nMeasures)						n			
EndFunc							n			
Func	**Number AudioAnalyzerMeasureEx(Number Channel, Number LimitMin, Number LimitMax, Number nMeasures, Number TimeOut)**						n			
Local	String AudioAnalyzerResult						n			
Local	Number AudioAnalyzerValue, AudioAnalyzerValueSum, MeasureCount						n			
Local	Number CurrentTime, MeasurementResult, AudioAnalyzerAverage						n			
	CurrentTime = Time()									
While	Time(CurrentTime) < TimeOut									

	MeasureCount = 0						n			
	AudioAnalyzerValueSum = 0						n			
While	MeasureCount < nMeasures						n			
If	Channel == 1						n			
	IbWrt(AudioAnalyzer, "sens:data1?")						n			
Else							n			
	IbWrt(AudioAnalyzer, "sens:data2?")						n			
EndIf							n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	AudioAnalyzerValue = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerValueSum = AudioAnalyzerValueSum + AudioAnalyzerValue						n			
	MeasureCount++						n			
EndWhile							n			
	AudioAnalyzerAverage = AudioAnalyzerValueSum / nMeasures									
	MeasurementResult = CheckLimits(AudioAnalyzerAverage, LimitMin, LimitMax)									
EndWhile	MeasurementResult == FALSE									
Return	AudioAnalyzerAverage						n			
EndFunc							n			
Func	**Number AudioAnalyzerWaitForMeasurementValue(Number Channel, Number LimitMin, Number LimitMax, Number TimeOut)**						n			
Local	String AudioAnalyzerResult						n			
Local	Number AudioAnalyzerValue, CurrentTime, MeasurementResult						n			
							n			
	CurrentTime = Time()						n			
While	Time(CurrentTime) < TimeOut						n			
If	Channel == 1						n			
	IbWrt(AudioAnalyzer, "sens:data1?")						n			
Else							n			
	IbWrt(AudioAnalyzer, "sens:data2?")						n			
EndIf							n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	AudioAnalyzerValue = atof(Mid(AudioAnalyzerResult,0,6))						n			
	MeasurementResult = CheckLimits(AudioAnalyzerValue, LimitMin, LimitMax)						n			
EndWhile	MeasurementResult == FALSE						n			
Return	MeasurementResult						n			
EndFunc							n			

Sub	**LoadCanBusConfig**						n			
	VisaWrite("Interface", "CAN:1:CFG:\"NissLCN2.txt\"")						n			
	VisaWrite("Interface", "CAN:1:ON")						n			
EndSub							n			
Func	**Number WaitForMeasurementValue(String MeasDevice, Number LimMin, Number LimMax, Number TimeOut)**									
Local	Number CurrTime						n			
Local	Number Measurement						n			
	CurrTime = Time()						n			
While	Time(CurrTime) < TimeOut						n			
	Measurement = CheckLimits(Measure(MeasDevice), LimMin, LimMax)						n			300
EndWhile	Measurement == FALSE						n			
Return	Measurement						n			
EndFunc										
Func	**Number VolumeControlByVoltageLevel(Number Channel, Number LimitMin, Number LimitMax, Number TimeOut)**						n			
Local	Number CurrentVoltageLevel, CurrentTime, RetValue						n			
	CurrentVoltageLevel = AudioAnalyzerMeasure(Channel, 10)						n			
If	CheckLimits(CurrentVoltageLevel, LimitMin, LimitMax) == TRUE						n			
Return	TRUE						n			
EndIf							n			
	RetValue = -1						n			
	CurrentTime = Time()						n			
While	RetValue == -1						n			
If	Time(CurrentTime) > TimeOut						n			
	RetValue = FALSE						n			
EndIf							n			
	Delay(200)						n			
	CurrentVoltageLevel = AudioAnalyzerMeasure(Channel, 10)						n			
If	CurrentVoltageLevel < LimitMin						n			
Call	IncreaseVolumeViaCanBus						n			
ElseIf	CurrentVoltageLevel > LimitMax						n			
Call	DecreaseVolumeViaCanBus						n			
Else							n			
	RetValue = TRUE						n			
EndIf							n			
EndWhile							n			

Return	RetValue						n			
EndFunc							n			

	// DUT Test Sub_Routines									
Sub	**PairMobilePhone**									
If	MsgBox("Pair the DUT with External Bluetooth PC with BT PEN/Mobile", "Bluetooth Pairing", MB_OKCANCEL | MB_ICONINFORMATION) == IDCANCEL						n			
End	"User Cancel!"						y			
EndIf							n			
EndSub										
Sub	**ComparingFMwithBT**						n			
	"TEST - 1 Comparing FM with BT by Sending 1KHz Signal"						y			
	"Step_1 Configuration in Audio Analyzer"						N			
//Call	//AudioAnalyzerInit						n			
	IbWrt(AudioAnalyzer, "sens:func 'RMS'")						n			
	IbWrt(AudioAnalyzer, "sens:filt1:ufil6 on")		HP22Hz ON				n			
	IbWrt(AudioAnalyzer, "sens:filt2:ufil1 on")		LP20.kHz ON				n			
	VisaWrite("Interface", "CH:Loads:Front")						n			
If	MsgBox("Play Track T02_1kHz", "ComparingFM with BT", MB_OKCANCEL | MB_ICONINFORMATION) == IDCANCEL						n			
End	"User Cancel!"						y			
EndIf							n			
	IbWrt(AudioAnalyzer, "SENS:UNIT1 V")						n			
If	0//MsgBox("Volume Step 23", "Comparing FM with BT", MB_OKCANCEL | MB_ICONINFORMATION) == IDCANCEL						n			
End	"User Cancel!"						y			
EndIf							n			
	VolumeControlByVoltageLevel(1, 1.45, 1.52, 60)			1	1		n			
	IbWrt(AudioAnalyzer, "SENS:REF:MODE CH1S")						n			
	IbWrt(AudioAnalyzer, "SENS:UNIT1 DBR")						n			
	"Step_2 Configuration in Signal Generator"						y			
Call	**RFSGSMLInit**						n			
	"Step_3 Measurement in Signal Generator"						y			
If	MsgBox("In DUT Change to Source as Radio-FM & Check FM Frequency", "Measurement in Signal Generator", MB_OKCANCEL | MB_ICONINFORMATION) == IDCANCEL						n			

End	"User Cancel!"						y			
EndIf							n			
	"Measuremnet in FM Signal"						y			
	AudioAnalyzerWaitForMeasurementValue(1, -12, -8, 10)						n			
	IbWrt(AudioAnalyzer, "sens:data1?")						n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	AudioAnalyzerL = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerL		Channel Left	-12	-8	dB	y			
	AudioAnalyzerWaitForMeasurementValue(2, -12, -8, 10)						n			
	IbWrt(AudioAnalyzer, "sens:data2?")						n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	AudioAnalyzerR = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerR		Channel Rigth	-12	-8	dB	y			
If	MsgBox("In DUT change from Radio-FM to Media & Play Track T02_1kHz ", "Measurement in Audio Analyzer", MB_OKCANCEL | MB_ICONINFORMATION) == IDCANCEL						n			
End	"User Cancel!"						y			
EndIf							n			
	"Measuremnet in BT Signal"						y			
	AudioAnalyzerWaitForMeasurementValue(1, -0.8, 0.6, 10)						n			
	IbWrt(AudioAnalyzer, "sens:data1?")						n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	AudioAnalyzerL = atof(Mid(AudioAnalyzerResult,0,6))						n			
	//AudioAnalyzerL = AudioAnalyzerMeasure(1, 10)						n			
	AudioAnalyzerL		Channel Left	-0,8	0,6	dB	y			
	AudioAnalyzerWaitForMeasurementValue(2, -0.9, 0.6, 20)						n			
	IbWrt(AudioAnalyzer, "sens:data2?")						n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	AudioAnalyzerR = atof(Mid(AudioAnalyzerResult,0,6))						n			
	//AudioAnalyzerR = AudioAnalyzerMeasure(2, 20)									
	AudioAnalyzerR		Channel Right	-0,9	0,6	dB	y			
EndSub										
Sub	**FrequencyResponseViaBT**						n			
//Call	//AudioAnalyzerInit						n			
Call	AudioAnalyzerConfigAsRMS						n			
	VisaWrite("Interface", "CH:Loads:Front")						n			
	"TEST - 2 Frequency Via BT"						y			
If	MsgBox("Play Track T02_1KHz", "Frequency Response via BT", MB_OKCANCEL | MB_ICONINFORMATION) == IDCANCEL						n			

End	"User Cancel!"						y			
EndIf							n			
	IbWrt(AudioAnalyzer, "SENS:UNIT1 V")						n			
	VolumeControlByVoltageLevel(1, 1.45, 1.52, 60)			1	1		n			
	IbWrt(AudioAnalyzer, "SENS:REF:MODE CH1S")						n			
	IbWrt(AudioAnalyzer, "SENS:UNIT1 DBR")						n			
	"Step_1 Low Frequency Audio Signal - 17Hz"						y			
If	MsgBox("Play Track T03_17Hz", "Frequency Response via BT", MB_OKCANCEL | MB_ICONINFORMATION) == IDCANCEL						n			
End	"User Cancel!"						y			
EndIf							n			
	AudioAnalyzerWaitForMeasurementValue(1, -3, 3, 10)						n			
	IbWrt(AudioAnalyzer, "sens:data1?")						n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	AudioAnalyzerL = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerL		Channel Left	-3	3	dB	y			
	AudioAnalyzerWaitForMeasurementValue(2, -3, 3, 10)						n			
	IbWrt(AudioAnalyzer, "sens:data2?")						n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	AudioAnalyzerR = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerR		Channel Rigth	-3	3	dB	y			
	"Step_2 High Frequency Audio Signal - 19.99kHz"						y			
If	MsgBox("Play Track T07_19.99kHz", "Frequency Response via BT", MB_OKCANCEL | MB_ICONINFORMATION) == IDCANCEL						n			
End	"User Cancel!"						y			
EndIf							n			
	AudioAnalyzerWaitForMeasurementValue(1, -3, 3, 10)						n			
	IbWrt(AudioAnalyzer, "sens:data1?")						n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	AudioAnalyzerL = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerL		Channel Left	-3	3	dB	y			
	AudioAnalyzerWaitForMeasurementValue(2, -3, 3, 10)						n			
	IbWrt(AudioAnalyzer, "sens:data2?")						n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	AudioAnalyzerR = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerR		Channel Rigth	-3	3	dB	y			
EndSub							n			
Sub	**DistortionMP3**						n			
//Call	//AudioAnalyzerInit						n			

Call	AudioAnalyzerConfigAsDistortion						n			
	VisaWrite("Interface", "CH:Loads:Front")						n			
	"TEST -3 Distortion MP3"						y			
If	MsgBox("Play Track T02_1kHz", "Distortion MP3", MB_OKCANCEL | MB_ICONINFORMATION) == IDCANCEL						n			
End	"User Cancel!"						y			
EndIf							n			
	AudioAnalyzerWaitForMeasurementValue(1, 0, 0.1, 10)						n			
	IbWrt(AudioAnalyzer, "sens:data1?")						n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	AudioAnalyzerL = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerL		Channel Left	0	0,1	%THD	y			
	AudioAnalyzerWaitForMeasurementValue(2, 0, 0.1, 10)						n			
	IbWrt(AudioAnalyzer, "sens:data2?")						n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	AudioAnalyzerR = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerR		Channel Rigth	0	0,1	%THD	y			
EndSub							n			
Sub	**SignalToNoiseRatio**						n			
Local	Number AudioAnalyzerL_1kHz, AudioAnalyzerR_1kHz, AudioAnalyzerL_WithoutSignal, AudioAnalyzerR_WithoutSignal, SignalToNoiseRatioL, SignalToNoiseRatioR						n			
//Call	//AudioAnalyzerInit						n			
	IbWrt(AudioAnalyzer, "sens:func 'RMS'")						n			
	IbWrt(AudioAnalyzer, "sens:filt1:ufil6 on")		HP22Hz ON				n			
	IbWrt(AudioAnalyzer, "sens:filt2:ufil1 on")		LP20.kHz ON				n			
	VisaWrite("Interface", "CH:Loads:Front")						n			
	"TEST - 4 Signal-to-noise ratio"						y			
If	MsgBox("Play Track T02_1kHz", "Signal to Noise Ratio", MB_OKCANCEL | MB_ICONINFORMATION) == IDCANCEL						n			
End	"User Cancel!"						y			
EndIf							n			
	IbWrt(AudioAnalyzer, "SENS:UNIT1 V")						n			
	VolumeControlByVoltageLevel(1, 1.45, 1.52, 60)			1	1		n			
	IbWrt(AudioAnalyzer, "SENS:REF:MODE CH1S")						n			
	IbWrt(AudioAnalyzer, "SENS:UNIT1 DBR")						n			

	"Audio Track with 1kHz Signal"						y			
	AudioAnalyzerWaitForMeasurementValue(1, -1, 1, 10)						n			
	IbWrt(AudioAnalyzer, "sens:data1?")						n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	AudioAnalyzerL_1kHz = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerL_1kHz		Channel Left			dB	y			
	AudioAnalyzerWaitForMeasurementValue(2, -0.5, 0.5, 10)						n			
	IbWrt(AudioAnalyzer, "sens:data2?")						n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	AudioAnalyzerR_1kHz = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerR_1kHz		Channel Rigth			dB	y			
If	MsgBox("Play Track T08_Inifinity zero", "Signal to Noise Ratio", MB_OKCANCEL | MB_ICONINFORMATION) == IDCANCEL						n			
End	"User Cancel!"						y			
EndIf							n			
	"Audio Track with Infinity zero"						y			
	//Delay(1000)						n			
	AudioAnalyzerWaitForMeasurementValue(1, -85, -75, 10)						n			
	IbWrt(AudioAnalyzer, "sens:data1?")						n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	AudioAnalyzerL_WithoutSignal = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerL_WithoutSignal		Channel Left			dB	y			
	//Delay(2000)						n			
	AudioAnalyzerWaitForMeasurementValue(2, -85, -75, 10)						n			
	IbWrt(AudioAnalyzer, "sens:data2?")						n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	AudioAnalyzerR_WithoutSignal = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerR_WithoutSignal		Channel Rigth			dB	y			
	//Delay(1000)									
	SignalToNoiseRatioL = AudioAnalyzerL_1kHz - AudioAnalyzerL_WithoutSignal						n			
	SignalToNoiseRatioR = AudioAnalyzerR_1kHz - AudioAnalyzerR_WithoutSignal						n			
	SignalToNoiseRatioL			70	999	dB	y			
	SignalToNoiseRatioR			70	999	dB	y			
EndSub										
Sub	**ChannelEquality**						n			

//Call	//AudioAnalyzerInit						n			
	"TEST - 6 Channel Equality"						y			
	VisaWrite("Interface", "CH:Loads:Front")						n			
	IbWrt(AudioAnalyzer, "sens:func 'RMS'")						n			
	IbWrt(AudioAnalyzer, "sens:filt1:ufil6 on")		HP22Hz ON				n			
	IbWrt(AudioAnalyzer, "sens:filt2:ufil1 on")		LP20.kHz ON				n			
	VisaWrite("Interface", "CH:Loads:Front")						n			
If	MsgBox("Play Track T02_1kHz", "Channel Equality", MB_OKCANCEL | MB_ICONINFORMATION) == IDCANCEL						n			
End	"User Cancel!"						y			
EndIf							n			
	IbWrt(AudioAnalyzer, "SENS:UNIT1 V")						n			
	VolumeControlByVoltageLevel(1, 1.45, 1.52, 60)			1	1		n			
	IbWrt(AudioAnalyzer, "SENS:REF:MODE CH1S")						n			
	IbWrt(AudioAnalyzer, "SENS:UNIT1 DBR")						n			
	"Step_1 Load in Front: FL & FR"						y			
	AudioAnalyzerWaitForMeasurementValue(1, -1, 1, 10)						n			
	IbWrt(AudioAnalyzer, "sens:data1?")						n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	AudioAnalyzerL = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerL		Channel Left	-1	1	dB	y			
	AudioAnalyzerWaitForMeasurementValue(2, -1, 1, 10)						n			
	IbWrt(AudioAnalyzer, "sens:data2?")						n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	AudioAnalyzerR = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerR		Channel Rigth	-1	1	dB	y			
	"Step_2 Load in REAR: RL & RR"						y			
	VisaWrite("Interface", "CH:Loads:Rear")						n			
If	MsgBox("Play Track T02_1kHz", "Channel Equality in REAR", MB_OKCANCEL | MB_ICONINFORMATION) == IDCANCEL						n			
End	"User Cancel!"						y			
EndIf							n			
	IbWrt(AudioAnalyzer, "SENS:UNIT1 V")						n			
	VolumeControlByVoltageLevel(1, 1.45, 1.52, 60)			1	1		n			
	IbWrt(AudioAnalyzer, "SENS:REF:MODE CH1S")						n			
	IbWrt(AudioAnalyzer, "SENS:UNIT1 DBR")						n			
	AudioAnalyzerWaitForMeasurementValue(1, -1, 1, 10)						n			
	IbWrt(AudioAnalyzer, "sens:data1?")						n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			

	AudioAnalyzerL = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerL		Channel Left	-1	1	dB	y			
	AudioAnalyzerWaitForMeasurementValue(2, -1, 1, 10)						n			
	IbWrt(AudioAnalyzer, "sens:data2?")						n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	AudioAnalyzerR = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerR		Channel Rigth	-1	1	dB	y			
EndSub										
Sub	**ChannelSeperation**						n			
//Call	//AudioAnalyzerInit						n			
	"TEST - 7 Channel Seperation"						y			
	VisaWrite("Interface", "CH:Loads:Front")						n			
	IbWrt(AudioAnalyzer, "sens:func 'RMS'")						n			
	IbWrt(AudioAnalyzer, "sens:filt1:ufil6 on")		HP22Hz ON				n			
	IbWrt(AudioAnalyzer, "sens:filt2:ufil1 on")		LP20.kHz ON				n			
	"Step_1 Signal in Left"						y			
If	MsgBox("Play Track T09_1kHz", "Signal in Left Channel", MB_OKCANCEL | MB_ICONINFORMATION) == IDCANCEL						n			
End	"User Cancel!"						y			
EndIf							n			
	IbWrt(AudioAnalyzer, "SENS:UNIT1 V")						n			
	VolumeControlByVoltageLevel(1, 1.45, 1.52, 60)			1	1		n			
	IbWrt(AudioAnalyzer, "SENS:REF:MODE CH1S")						n			
	IbWrt(AudioAnalyzer, "SENS:UNIT1 DBR")						n			
	AudioAnalyzerWaitForMeasurementValue(1, -0.5, 0.5, 10)						n			
	IbWrt(AudioAnalyzer, "sens:data1?")						n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	AudioAnalyzerL = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerL		Channel Left	-0,5	0,5	dB	y			
	AudioAnalyzerWaitForMeasurementValue(2, -80, -70, 10)						n			
	IbWrt(AudioAnalyzer, "sens:data2?")						n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	AudioAnalyzerR = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerR		Channel Rigth	-80	-70	dB	y			
	"Step_2 Signal in Right"						y			
If	MsgBox("Play Track T11_1kHz", "Signal in Right Channel", MB_OKCANCEL | MB_ICONINFORMATION) == IDCANCEL						n			
End	"User Cancel!"						y			
EndIf							n			

	IbWrt(AudioAnalyzer, "SENS:UNIT2 V")						n			
	VolumeControlByVoltageLevel(2, 1.40, 1.50, 60)			1	1		n			
	IbWrt(AudioAnalyzer, "SENS:REF:MODE CH2S")						n			
	IbWrt(AudioAnalyzer, "SENS:UNIT2 DBR")						n			
	AudioAnalyzerWaitForMeasurementValue(1, -80, -70, 10)						n			
	IbWrt(AudioAnalyzer, "sens:data1?")						n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	AudioAnalyzerL = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerL		Channel Left	-80	-70	dB	y			
	AudioAnalyzerWaitForMeasurementValue(2, -0.5, 0.5, 10)						n			
	IbWrt(AudioAnalyzer, "sens:data2?")						n			
	AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	AudioAnalyzerR = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerR		Channel Rigth	-0,5	0,5	dB	y			
EndSub										
Sub	**VolumeCharacteristics**						n			
//Call	//AudioAnalyzerInit						n			
//Call	//LoadCanBusConfig						n			
	"TEST - 5 Volume Characteristics"						y			
	VisaWrite("Interface", "CH:Loads:Front")						n			
	IbWrt(AudioAnalyzer, "sens:func 'RMS'")						n			
	IbWrt(AudioAnalyzer, "sens:filt1:ufil6 off")		HP22Hz OFF				n			
	IbWrt(AudioAnalyzer, "sens:filt2:ufil1 off")		LP20.kHz OFF				n			
	IbWrt(AudioAnalyzer, "SENS:FILT:CCIU ON")		CCIR Unwtd ON				n			
If	MsgBox("Play Track T16_1kHz", "1KHz Signal with -20dB_Volume Characteristics", MB_OKCANCEL | MB_ICONINFORMATION) == IDCANCEL						n			
End	"User Cancel!"						y			
EndIf							n			
	IbWrt(AudioAnalyzer, "SENS:UNIT1 V")						n			
	VolumeControlByVoltageLevel(1, 1.90, 2.05, 60)			1	1		n			
	Delay(100)						n			
	IbWrt(AudioAnalyzer, "SENS:REF:MODE CH1S")						n			
	IbWrt(AudioAnalyzer, "SENS:UNIT1 DBR")						n			
	//IbWrt(AudioAnalyzer, "SENS:UNIT1 V")						y			
If	0//MsgBox("**Adjust the Volume Step of DUT to Maximum - To Keep Value in Channel_1 Va = 2.0V**", "**Reference in Channel 1_Volume Characteristics**", MB_OKCANCEL | MB_ICONINFORMATION) == IDCANCEL						n			

End	"User Cancel!"						y			
EndIf							n			
	Delay(100)									
	//IbWrt(AudioAnalyzer, "sens:data1?")						n			
	//AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						y			
	//IbWrt(AudioAnalyzer, "SENS:REF:MODE CH1S")						y			
	//IbWrt(AudioAnalyzer, "SENS:UNIT1 DBR")						y			
	IbWrt(AudioAnalyzer, "SENS:UNIT1 V")						n			
	VolumeControlByVoltageLevel(1, 0.000100, 0.000190, 60)			1	1		n			
	IbWrt(AudioAnalyzer, "SENS:UNIT1 DBR")						n			
If	0//MsgBox("**Adjust the Volume Step of DUT to Mute**", "**Volume Characteristics**", MB_OKCANCEL | MB_ICONINFORMATION) == IDCANCEL						n			
End	"User Cancel!"						y			
EndIf							n			
	AudioAnalyzerWaitForMeasurementValue(1, -84, -82, 10)						n			
	//IbWrt(AudioAnalyzer, "sens:data1?")						n			
	//AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	//AudioAnalyzerL = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerL = AudioAnalyzerMeasureEx(1, -84, -82, 3, 10)						n			
	AudioAnalyzerL		Volume Step_0 Channel Left	-84	-82	dB	y			
	AudioAnalyzerWaitForMeasurementValue(2, -84, -82, 10)						n			
	//IbWrt(AudioAnalyzer, "sens:data2?")						n			
	//AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	//AudioAnalyzerR = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerR = AudioAnalyzerMeasureEx(2, -84, -82, 3, 10)						n			
	AudioAnalyzerR = Round(AudioAnalyzerR, 0)						n			
	AudioAnalyzerR		Volume Step_0 Channel Right	-84	-82	dB	y			
If	0//MsgBox("Increase the Volume of DUT to Step 1", "**Reference in Channel 2**", MB_OKCANCEL | MB_ICONINFORMATION) == IDCANCEL						n			
End	"User Cancel!"						y			
EndIf							n			
Call	IncreaseVolumeViaCanBus						n			
	AudioAnalyzerWaitForMeasurementValue(1, -80, -78, 10)						n			
	//IbWrt(AudioAnalyzer, "sens:data1?")						n			
	//AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	//AudioAnalyzerL = atof(Mid(AudioAnalyzerResult,0,6))						n			

	AudioAnalyzerL = AudioAnalyzerMeasureEx(1, -80, -78, 3, 10)						n			
	AudioAnalyzerL		Volume Step_1 Channel Left	-80	-78	dB	y			
	AudioAnalyzerWaitForMeasurementValue(2, -80, -78, 10)						n			
	//IbWrt(AudioAnalyzer, "sens:data2?")						n			
	//AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	//AudioAnalyzerR = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerR = AudioAnalyzerMeasureEx(2, -80, -78, 3, 10)						n			
	AudioAnalyzerR = Round(AudioAnalyzerR, 0)						n			
	AudioAnalyzerR		Volume Step_1 Channel Right	-80	-78	dB	y			
If	0//MsgBox("Increase the Volume of DUT to Step 2", "**Reference in Channel 2**", MB_OKCANCEL | MB_ICONINFORMATION) == IDCANCEL						n			
End	"User Cancel!"						y			
EndIf							n			
Call	IncreaseVolumeViaCanBus						n			
	AudioAnalyzerWaitForMeasurementValue(1, -72, -70, 10)						n			
	//IbWrt(AudioAnalyzer, "sens:data1?")						n			
	//AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	//AudioAnalyzerL = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerL = AudioAnalyzerMeasureEx(1, -72, -70, 3, 10)						n			
	AudioAnalyzerL		Volume Step_2 Channel Left	-72	-70	dB	y			
	AudioAnalyzerWaitForMeasurementValue(2, -72, -70, 10)						n			
	//IbWrt(AudioAnalyzer, "sens:data2?")						n			
	//AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			
	//AudioAnalyzerR = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerR = AudioAnalyzerMeasureEx(2, -72, -70, 3, 10)						n			
	AudioAnalyzerR = Round(AudioAnalyzerR, 0)						n			
	AudioAnalyzerR		Volume Step_2 Channel Rigth	-72	-70	dB	y			
If	0//MsgBox("Increase the Volume of DUT to Step 3", "**Reference in Channel 2**", MB_OKCANCEL | MB_ICONINFORMATION) == IDCANCEL						n			
End	"User Cancel!"						y			
EndIf							n			
Call	IncreaseVolumeViaCanBus						n			
	AudioAnalyzerWaitForMeasurementValue(1, -64, -62, 10)						n			
	//IbWrt(AudioAnalyzer, "sens:data1?")						n			
	//AudioAnalyzerResult = Str(IbRead(AudioAnalyzer))						n			

	//AudioAnalyzerL = atof(Mid(AudioAnalyzerResult,0,6))						n			
	AudioAnalyzerL = AudioAnalyzerMeasureEx(1, -64, -62, 3, 10)						n			
	AudioAnalyzerL		Volume Step_3 Channel Left	-64	-62	dB	y			

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StepID	Step Description	Expression	Evaluation Result	Unit	Lower Lim	Upper Lim	Ok	Time
BlauKit:5.9.13; ActiveX:5.687; User:MIA1BRG; Host:PT-D0122; Temperature:Ambient Department:BrgP/ENG-PVT; Date:06/06/2017								
		"Power ON"	Power ON					14:30:35:105 S
		Consumption	797.214246	mA	700	900	Ok	14:30:40:175 N
		"Testing in Nominal Votage V = 13.5V/Room Temperature"	Testing in Nominal Votage V = 13.5V/Room Temperature					14:30:40:175 S
		"Audio Analyzer Initialization"	Audio Analyzer Initialization					14:30:40:185 S
		"TEST - 1 Comparing FM with BT by Sending 1KHz Signal"	TEST - 1 Comparing FM with BT by Sending 1KHz Signal					14:31:45:390 S
		"Step_2 Configuration in Signal Generator"	Step_2 Configuration in Signal Generator					14:31:49:060 S
		"Signal Genertator Initialization"	Signal Genertator Initialization					14:31:49:070 S
		"Signal Genertator Frequency Configuration"	Signal Genertator Frequency Configuration					14:31:49:080 S
		"Signal Genertator Level Configuration"	Signal Genertator Level Configuration					14:31:49:080 S
		"Signal Genertator Audio Frequency Configuration"	Signal Genertator Audio Frequency Configuration					14:31:49:090 S
		"Signal Genertator Modulation Tyep Configuration"	Signal Genertator Modulation Tyep Configuration					14:31:49:100 S
		"Step_3 Measurement in Signal Generator"	Step_3 Measurement in Signal Generator					14:31:49:110 S
		"Measuremnet in FM Signal"	Measuremnet in FM Signal					14:32:05:411 S
	Channel Left	AudioAnalyzerL	-11.03	dB	-12	-8	Ok	14:32:05:431 N
	Channel Rigth	AudioAnalyzerR	-11.55	dB	-12	-8	Ok	14:32:05:451 N
		"Measuremnet in BT Signal"	Measuremnet in BT Signal					14:32:08:242 S
	Channel Left	AudioAnalyzerL	-0.055	dB	-0.8	0.6	Ok	14:32:09:452 N
	Channel Right	AudioAnalyzerR	-0.561	dB	-0.9	0.6	Ok	14:32:09:472 N
		"Audio Analyzer RMS Configuration"	Audio Analyzer RMS Configuration					14:32:09:472 S
		"TEST - 2 Frequency Via BT"	TEST - 2 Frequency Via BT					14:32:09:762 S
		"Step_1 Low Frequency Audio Signal - 17Hz"	Step_1 Low Frequency Audio Signal - 17Hz					14:32:11:902 S
	Channel Left	AudioAnalyzerL	2.5567	dB	-3	3	Ok	14:32:21:163 N
	Channel Rigth	AudioAnalyzerR	2.0477	dB	-3	3	Ok	14:32:21:173 N
		"Step_2 High Frequency Audio Signal - 19.99kHz"	Step_2 High Frequency Audio Signal - 19.99kHz					14:32:21:183 S
	Channel Left	AudioAnalyzerL	-0.288	dB	-3	3	Ok	14:32:26:523 N
	Channel Rigth	AudioAnalyzerR	-0.836	dB	-3	3	Ok	14:32:26:543 N
		"Audio Analyzer Distortion Configuration"	Audio Analyzer Distortion Configuration					14:32:26:553 S
		"TEST -3 Distortion MP3"	TEST -3 Distortion MP3					14:32:27:403 S
	Channel Left	AudioAnalyzerL	0.0835	%	0	0.1	Ok	14:32:31:013 N
	Channel Rigth	AudioAnalyzerR	0.084	%	0	0.1	Ok	14:32:31:033 N
		"TEST - 4 Signal-to-noise ratio"	TEST - 4 Signal-to-noise ratio					14:32:31:364 S
		"Audio Track with 1kHz Signal"	Audio Track with 1kHz Signal					14:32:34:474 S
	Channel Left	AudioAnalyzerL_1kHz	-0.042	dB				14:32:34:644 N
	Channel Rigth	AudioAnalyzerR_1kHz	-0.487	dB				14:32:34:784 N
		"Audio Track with Infinity zero"	Audio Track with Infinity zero					14:32:39:704 S
	Channel Left	AudioAnalyzerL_WithoutSignal	-80.04	dB				14:32:40:844 N
	Channel Rigth	AudioAnalyzerR_WithoutSignal	-80.57	dB				14:32:40:884 N
		SignalToNoiseRatioL	79.998	dB	70	999	Ok	14:32:40:894 N

StepID	Step Description	Expression	Evaluation Result	Unit	Lower Lim	Upper Lim	Ok	Time
		SignalToNoiseRatioR	80.083	dB	70	999	Ok	14:32:40:914 N
		"TEST - 5 Volume Characteristics"	TEST - 5 Volume Characteristics					14:32:40:924 S
	Volume Step_0 Channel Left	AudioAnalyzerL	-82.47	dB	-84	-82	Ok	14:33:07:176 N
	Volume Step_0 Channel Right	AudioAnalyzerR	-83	dB	-84	-82	Ok	14:33:07:206 N
	Volume Step_1 Channel Left	AudioAnalyzerL	-78.35	dB	-80	-78	Ok	14:33:07:386 N
	Volume Step_1 Channel Right	AudioAnalyzerR	-79	dB	-80	-78	Ok	14:33:07:416 N
	Volume Step_2 Channel Left	AudioAnalyzerL	-71.34	dB	-72	-70	Ok	14:33:07:816 N
	Volume Step_2 Channel Rigth	AudioAnalyzerR	-72	dB	-72	-70	Ok	14:33:07:856 N
	Volume Step_3 Channel Left	AudioAnalyzerL	-63.41	dB	-64	-62	Ok	14:33:08:106 N
	Volume Step_3 Channel Rigth	AudioAnalyzerR	-64	dB	-64	-62	Ok	14:33:08:136 N
	Volume Step_4 Channel Left	AudioAnalyzerL	-57.42	dB	-58	-56	Ok	14:33:08:426 N
	Volume Step_4 Channel Rigth	AudioAnalyzerR	-58	dB	-58	-56	Ok	14:33:08:466 N
	Volume Step_5 Channel Left	AudioAnalyzerL	-53.42	dB	-54	-52	Ok	14:33:08:976 N
	Volume Step_5 Channel Rigth	AudioAnalyzerR	-54	dB	-54	-52	Ok	14:33:09:016 N
	Volume Step_6 Channel Left	AudioAnalyzerL	-50.39	dB	-51	-49	Ok	14:33:09:256 N
	Volume Step_6 Channel Rigth	AudioAnalyzerR	-51	dB	-51	-49	Ok	14:33:09:286 N
	Volume Step_7 Channel Left	AudioAnalyzerL	-47.82	dB	-48	-46	Ok	14:33:09:456 N
	Volume Step_7 Channel Rigth	AudioAnalyzerR	-48	dB	-48	-46	Ok	14:33:09:576 N
	Volume Step_8 Channel Left	AudioAnalyzerL	-45.41	dB	-46	-44	Ok	14:33:09:776 N
	Volume Step_8 Channel Rigth	AudioAnalyzerR	-46	dB	-46	-44	Ok	14:33:09:816 N
	Volume Step_9 Channel Left	AudioAnalyzerL	-43.39	dB	-44	-42	Ok	14:33:10:056 N
	Volume Step_9 Channel Rigth	AudioAnalyzerR	-44	dB	-44	-42	Ok	14:33:10:096 N
	Volume Step_10 Channel Left	AudioAnalyzerL	-41.57	dB	-42	-40	Ok	14:33:10:256 N

StepID	Step Description	Expression	Evaluation Result	Unit	Lower Lim	Upper Lim	Ok	Time
	Volume Step_10 Channel Rigth	AudioAnalyzerR	-42	dB	-42	-40	Ok	14:33:10:376 N
	Volume Step_11 Channel Left	AudioAnalyzerL	-39.54	dB	-40	-38	Ok	14:33:10:576 N
	Volume Step_11 Channel Rigth	AudioAnalyzerR	-40	dB	-40	-38	Ok	14:33:10:646 N
	Volume Step_12 Channel Left	AudioAnalyzerL	-37.38	dB	-38	-36	Ok	14:33:11:117 N
	Volume Step_12 Channel Rigth	AudioAnalyzerR	-38	dB	-38	-36	Ok	14:33:11:156 N
	Volume Step_13 Channel Left	AudioAnalyzerL	-35.38	dB	-36	-34	Ok	14:33:11:397 N
	Volume Step_13 Channel Rigth	AudioAnalyzerR	-36	dB	-36	-34	Ok	14:33:11:437 N
	Volume Step_14 Channel Left	AudioAnalyzerL	-34.38	dB	-35	-33	Ok	14:33:11:977 N
	Volume Step_14 Channel Rigth	AudioAnalyzerR	-35	dB	-35	-33	Ok	14:33:12:017 N
	Volume Step_15 Channel Left	AudioAnalyzerL	-32.38	dB	-33	-31	Ok	14:33:12:257 N
	Volume Step_15 Channel Rigth	AudioAnalyzerR	-33	dB	-33	-31	Ok	14:33:12:297 N
	Volume Step_16 Channel Left	AudioAnalyzerL	-31.66	dB	-32	-30	Ok	14:33:12:447 N
	Volume Step_16 Channel Rigth	AudioAnalyzerR	-32	dB	-32	-30	Ok	14:33:12:577 N
	Volume Step_17 Channel Left	AudioAnalyzerL	-30.49	dB	-31	-29	Ok	14:33:12:767 N
	Volume Step_17 Channel Rigth	AudioAnalyzerR	-31	dB	-31	-29	Ok	14:33:12:817 N
	Volume Step_18 Channel Left	AudioAnalyzerL	-29.91	dB	-30	-28	Ok	14:33:12:967 N
	Volume Step_18 Channel Rigth	AudioAnalyzerR	-30	dB	-30	-28	Ok	14:33:13:057 N
	Volume Step_19 Channel Left	AudioAnalyzerL	-27.38	dB	-28	-26	Ok	14:33:13:247 N
	Volume Step_19 Channel Rigth	AudioAnalyzerR	-28	dB	-28	-26	Ok	14:33:13:297 N
	Volume Step_20 Channel Left	AudioAnalyzerL	-26.64	dB	-27	-25	Ok	14:33:13:447 N
	Volume Step_20 Channel Rigth	AudioAnalyzerR	-27	dB	-27	-25	Ok	14:33:13:567 N
	Volume Step_21 Channel Left	AudioAnalyzerL	-25.52	dB	-26	-24	Ok	14:33:13:777 N

StepID	Step Description	Expression	Evaluation Result	Unit	Lower Lim	Upper Lim	Ok	Time
	Volume Step_21 Channel Rigth	AudioAnalyzerR	-26	dB	-26	-24	Ok	14:33:13:847 N
	Volume Step_22 Channel Left	AudioAnalyzerL	-23.42	dB	-24	-22	Ok	14:33:14:047 N
	Volume Step_22 Channel Rigth	AudioAnalyzerR	-24	dB	-24	-22	Ok	14:33:14:087 N
	Volume Step_23 Channel Left	AudioAnalyzerL	-22.65	dB	-23	-21	Ok	14:33:14:237 N
	Volume Step_23 Channel Rigth	AudioAnalyzerR	-23	dB	-23	-21	Ok	14:33:14:367 N
	Volume Step_24 Channel Left	AudioAnalyzerL	-21.39	dB	-22	-20	Ok	14:33:14:567 N
	Volume Step_24 Channel Rigth	AudioAnalyzerR	-22	dB	-22	-20	Ok	14:33:14:607 N
	Volume Step_25 Channel Left	AudioAnalyzerL	-19.38	dB	-20	-18	Ok	14:33:14:837 N
	Volume Step_25 Channel Rigth	AudioAnalyzerR	-20	dB	-20	-18	Ok	14:33:14:877 N
	Volume Step_26 Channel Left	AudioAnalyzerL	-18.38	dB	-19	-17	Ok	14:33:15:417 N
	Volume Step_26 Channel Rigth	AudioAnalyzerR	-19	dB	-19	-17	Ok	14:33:15:457 N
	Volume Step_27 Channel Left	AudioAnalyzerL	-17.86	dB	-18	-16	Ok	14:33:15:617 N
	Volume Step_27 Channel Rigth	AudioAnalyzerR	-18	dB	-18	-16	Ok	14:33:15:697 N
	Volume Step_28 Channel Left	AudioAnalyzerL	-15.38	dB	-16	-14	Ok	14:33:16:157 N
	Volume Step_28 Channel Rigth	AudioAnalyzerR	-16	dB	-16	-14	Ok	14:33:16:197 N
	Volume Step_29 Channel Left	AudioAnalyzerL	-14.84	dB	-15	-13	Ok	14:33:16:367 N
	Volume Step_29 Channel Rigth	AudioAnalyzerR	-15	dB	-15	-13	Ok	14:33:16:447 N
	Volume Step_30 Channel Left	AudioAnalyzerL	-13.38	dB	-14	-12	Ok	14:33:16:637 N
	Volume Step_30 Channel Rigth	AudioAnalyzerR	-14	dB	-14	-12	Ok	14:33:16:687 N
	Volume Step_31 Channel Left	AudioAnalyzerL	-12.66	dB	-13	-11	Ok	14:33:16:847 N
	Volume Step_31 Channel Rigth	AudioAnalyzerR	-13	dB	-13	-11	Ok	14:33:16:967 N
	Volume Step_32 Channel Left	AudioAnalyzerL	-10.74	dB	-11	-9	Ok	14:33:17:157 N

StepID	Step Description	Expression	Evaluation Result	Unit	Lower Lim	Upper Lim	Ok	Time
	Volume Step_32 Channel Rigth	AudioAnalyzerR	-11	dB	-11	-9	Ok	14:33:17:237 N
	Volume Step_33 Channel Left	AudioAnalyzerL	-9.383	dB	-10	-8	Ok	14:33:17:437 N
	Volume Step_33 Channel Rigth	AudioAnalyzerR	-10	dB	-10	-8	Ok	14:33:17:487 N
	Volume Step_34 Channel Left	AudioAnalyzerL	-8.722	dB	-9	-7	Ok	14:33:17:647 N
	Volume Step_34 Channel Rigth	AudioAnalyzerR	-9	dB	-9	-7	Ok	14:33:17:767 N
	Volume Step_35 Channel Left	AudioAnalyzerL	-5.931	dB	-7	-5	Ok	14:33:17:967 N
	Volume Step_35 Channel Rigth	AudioAnalyzerR	-6	dB	-7	-5	Ok	14:33:18:007 N
	Volume Step_36 Channel Left	AudioAnalyzerL	-5.925	dB	-6	-4	Ok	14:33:18:107 N
	Volume Step_36 Channel Rigth	AudioAnalyzerR	-6	dB	-6	-4	Ok	14:33:18:167 N
	Volume Step_37 Channel Left	AudioAnalyzerL	-4.846	dB	-5	-3	Ok	14:33:18:257 N
	Volume Step_37 Channel Rigth	AudioAnalyzerR	-4	dB	-5	-3	Ok	14:33:18:367 N
	Volume Step_38 Channel Left	AudioAnalyzerL	-2.474	dB	-3	-1	Ok	14:33:18:557 N
	Volume Step_38 Channel Rigth	AudioAnalyzerR	-3	dB	-3	-1	Ok	14:33:18:607 N
	Volume Step_39 channel Left	AudioAnalyzerL	-1.583	dB	-2	0	Ok	14:33:18:767 N
	Volume Step_39 Channel Rigth	AudioAnalyzerR	-2	dB	-2	0	Ok	14:33:18:847 N
	Volume Step_40 Channel Left	AudioAnalyzerL	0.0664	dB	-1	1	Ok	14:33:19:297 N
	Volume Step_40 Channel Rigth	AudioAnalyzerR	0	dB	-1	1	Ok	14:33:19:347 N
		"TEST - 6 Channel Equality"	TEST - 6 Channel Equality					14:33:19:377 S
		"Step_1 Load in Front: FL & FR"	Step_1 Load in Front: FL & FR					14:33:36:168 S
	Channel Left	AudioAnalyzerL	0	dB	-1	1	Ok	14:33:36:348 N
	Channel Rigth	AudioAnalyzerR	-0.382	dB	-1	1	Ok	14:33:36:388 N
		"Step_2 Load in REAR: RL & RR"	Step_2 Load in REAR: RL & RR					14:33:36:418 S
	Channel Left	AudioAnalyzerL	0	dB	-1	1	Ok	14:33:41:169 N
	Channel Rigth	AudioAnalyzerR	0.0107	dB	-1	1	Ok	14:33:41:209 N
		"TEST - 7 Channel Seperation"	TEST - 7 Channel Seperation					14:33:41:239 S
		"Step_1 Signal in Left"	Step_1 Signal in Left					14:33:41:539 S
	Channel Left	AudioAnalyzerL	0.0002	dB	-0.5	0.5	Ok	14:33:57:030 N
	Channel Rigth	AudioAnalyzerR	-77.07	dB	-80	-70	Ok	14:33:57:680 N

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StepID	Step Description	Expression	Evaluation Result	Unit	Lower Lim	Upper Lim	Ok	Time
		"Step_2 Signal in Right"	Step_2 Signal in Right					14:33:57:710 S
	Channel Left	AudioAnalyzerL	-72.31	dB	-80	-70	Ok	14:34:34:893 N
	Channel Rigth	AudioAnalyzerR	0.0006	dB	-0.5	0.5	Ok	14:34:34:923 N
		"Power OFF"	Power OFF					14:34:34:953 S
		"Testing in Under Votage V = 10.8V/Room Temperature"	Testing in Under Votage V = 10.8V/Room Temperature					14:34:38:033 S
		"Power ON"	Power ON					14:34:38:063 S
		"Audio Analyzer Initialization"	Audio Analyzer Initialization					14:34:38:103 S
		"Audio Analyzer RMS Configuration"	Audio Analyzer RMS Configuration					14:35:04:895 S
		"TEST - 2 Frequency Via BT"	TEST - 2 Frequency Via BT					14:35:05:205 S
		"Step_1 Low Frequency Audio Signal - 17Hz"	Step_1 Low Frequency Audio Signal - 17Hz					14:35:07:995 S
	Channel Left	AudioAnalyzerL	0	dB	-3	3	Ok	14:35:11:095 N
	Channel Rigth	AudioAnalyzerR	-0.42	dB	-3	3	Ok	14:35:11:135 N
		"Step_2 High Frequency Audio Signal - 19.99kHz"	Step_2 High Frequency Audio Signal - 19.99kHz					14:35:11:165 S
	Channel Left	AudioAnalyzerL	2.5549	dB	-3	3	Ok	14:35:14:356 N
	Channel Rigth	AudioAnalyzerR	2.145	dB	-3	3	Ok	14:35:14:396 N
		"Audio Analyzer Distortion Configuration"	Audio Analyzer Distortion Configuration					14:35:14:426 S
		"TEST -3 Distortion MP3"	TEST -3 Distortion MP3					14:35:15:286 S
	Channel Left	AudioAnalyzerL	0.0889	%	0	0.1	Ok	14:35:18:816 N
	Channel Rigth	AudioAnalyzerR	0.0891	%	0	0.1	Ok	14:35:18:856 N
		"TEST - 4 Signal-to-noise ratio"	TEST - 4 Signal-to-noise ratio					14:35:19:196 S
		"Audio Track with 1kHz Signal"	Audio Track with 1kHz Signal					14:35:21:416 S
	Channel Left	AudioAnalyzerL_1kHz	0.0001	dB				14:35:21:596 N
	Channel Rigth	AudioAnalyzerR_1kHz	-0.402	dB				14:35:21:636 N
		"Audio Track with Infinity zero"	Audio Track with Infinity zero					14:35:26:317 S
	Channel Left	AudioAnalyzerL_WithoutSignal	-79.54	dB				14:35:27:327 N
	Channel Rigth	AudioAnalyzerR_WithoutSignal	-80.06	dB				14:35:27:367 N
		SignalToNoiseRatioL	79.5401	dB	70	999	Ok	14:35:27:397 N
		SignalToNoiseRatioR	79.658	dB	70	999	Ok	14:35:27:427 N
		"TEST - 6 Channel Equality"	TEST - 6 Channel Equality					14:35:27:457 S
		"Step_1 Load in Front: FL & FR"	Step_1 Load in Front: FL & FR					14:35:32:498 S
	Channel Left	AudioAnalyzerL	0	dB	-1	1	Ok	14:35:32:678 N
	Channel Rigth	AudioAnalyzerR	-0.414	dB	-1	1	Ok	14:35:32:708 N
		"Step_2 Load in REAR: RL & RR"	Step_2 Load in REAR: RL & RR					14:35:32:728 S
	Channel Left	AudioAnalyzerL	0	dB	-1	1	Ok	14:35:36:598 N
	Channel Rigth	AudioAnalyzerR	0.0197	dB	-1	1	Ok	14:35:36:628 N
		"TEST - 7 Channel Seperation"	TEST - 7 Channel Seperation					14:35:36:658 S
		"Step_1 Signal in Left"	Step_1 Signal in Left					14:35:36:948 S
	Channel Left	AudioAnalyzerL	0.0004	dB	-0.5	0.5	Ok	14:35:56:209 N
	Channel Rigth	AudioAnalyzerR	-76.53	dB	-80	-70	Ok	14:35:56:249 N
		"Step_2 Signal in Right"	Step_2 Signal in Right					14:35:56:279 S
	Channel Left	AudioAnalyzerL	-72.39	dB	-80	-70	Ok	14:36:06:630 N
	Channel Rigth	AudioAnalyzerR	0.0039	dB	-0.5	0.5	Ok	14:36:06:660 N
		"Power OFF"	Power OFF					14:36:06:690 S

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StepID	Step Description	Expression	Evaluation Result	Unit	Lower Lim	Upper Lim	Ok	Time
		"Power ON"	Power ON					14:36:09:770 S
		"Audio Analyzer Initialization"	Audio Analyzer Initialization					14:36:09:810 S
		"Audio Analyzer RMS Configuration"	Audio Analyzer RMS Configuration					14:36:33:012 S
		"TEST - 2 Frequency Via BT"	TEST - 2 Frequency Via BT					14:36:33:312 S
		"Step_1 Low Frequency Audio Signal - 17Hz"	Step_1 Low Frequency Audio Signal - 17Hz					14:36:36:222 S
	Channel Left	AudioAnalyzerL	2.5521	dB	-3	3	Ok	14:36:41:733 N
	Channel Rigth	AudioAnalyzerR	2.097	dB	-3	3	Ok	14:36:41:773 N
		"Step_2 High Frequency Audio Signal - 19.99kHz"	Step_2 High Frequency Audio Signal - 19.99kHz					14:36:41:803 S
	Channel Left	AudioAnalyzerL	2.5563	dB	-3	3	Ok	14:36:45:233 N
	Channel Rigth	AudioAnalyzerR	2.1123	dB	-3	3	Ok	14:36:45:263 N
		"Audio Analyzer Distortion Configuration"	Audio Analyzer Distortion Configuration					14:36:45:293 S
		"TEST -3 Distortion MP3"	TEST -3 Distortion MP3					14:36:46:163 S
	Channel Left	AudioAnalyzerL	0.0822	%	0	0.1	Ok	14:36:51:533 N
	Channel Rigth	AudioAnalyzerR	0.0824	%	0	0.1	Ok	14:36:51:563 N
		"TEST - 4 Signal-to-noise ratio"	TEST - 4 Signal-to-noise ratio					14:36:51:914 S
		"Audio Track with 1kHz Signal"	Audio Track with 1kHz Signal					14:36:54:494 S
	Channel Left	AudioAnalyzerL_1kHz	0.0001	dB				14:36:54:674 N
	Channel Rigth	AudioAnalyzerR_1kHz	-0.426	dB				14:36:54:704 N
		"Audio Track with Infinity zero"	Audio Track with Infinity zero					14:36:58:734 S
	Channel Left	AudioAnalyzerL_WithoutSignal	-75.77	dB				14:37:00:044 N
	Channel Rigth	AudioAnalyzerR_WithoutSignal	-79.93	dB				14:37:00:074 N
		SignalToNoiseRatioL	75.7701	dB	70	999	Ok	14:37:00:094 N
		SignalToNoiseRatioR	79.504	dB	70	999	Ok	14:37:00:124 N
		"TEST - 6 Channel Equality"	TEST - 6 Channel Equality					14:37:00:154 S
		"Step_1 Load in Front: FL & FR"	Step_1 Load in Front: FL & FR					14:37:06:845 S
	Channel Left	AudioAnalyzerL	0	dB	-1	1	Ok	14:37:07:115 N
	Channel Rigth	AudioAnalyzerR	-0.426	dB	-1	1	Ok	14:37:07:155 N
		"Step_2 Load in REAR: RL & RR"	Step_2 Load in REAR: RL & RR					14:37:07:185 S
	Channel Left	AudioAnalyzerL	0.0005	dB	-1	1	Ok	14:37:10:515 N
	Channel Rigth	AudioAnalyzerR	0.015	dB	-1	1	Ok	14:37:10:545 N
		"TEST - 7 Channel Seperation"	TEST - 7 Channel Seperation					14:37:10:575 S
		"Step_1 Signal in Left"	Step_1 Signal in Left					14:37:10:875 S
	Channel Left	AudioAnalyzerL	0.0001	dB	-0.5	0.5	Ok	14:37:31:056 N
	Channel Rigth	AudioAnalyzerR	-76.75	dB	-80	-70	Ok	14:37:31:086 N
		"Step_2 Signal in Right"	Step_2 Signal in Right					14:37:31:116 S
	Channel Left	AudioAnalyzerL	-72.6	dB	-80	-70	Ok	14:37:39:327 N
	Channel Rigth	AudioAnalyzerR	0.0039	dB	-0.5	0.5	Ok	14:37:39:357 N
		"Power OFF"	Power OFF					14:37:39:387 S

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StepID	Step Description	Expression	Evaluation Result	Unit	Lower Lim	Upper Lim	Ok	Time
BlauKit:5.9.13; ActiveX:5.687; User:MIA1BRG; Host:PT-D0122; Temperature:Ambient Department:BrgP/ENG-PVT; Date:25/05/2017								
		"Power ON"	Power ON					11:53:15:608 S
		Consumption	804.0082243	mA	700	900	Ok	11:53:20:669 N
		"Testing in Nominal Votage V = 13.5V/Room Temperature"	Testing in Nominal Votage V = 13.5V/Room Temperature					11:53:20:669 S
		"Audio Analyzer Initialization"	Audio Analyzer Initialization					11:53:20:679 S
		"TEST - 1 Comparing FM with BT by Sending 1KHz Signal"	TEST - 1 Comparing FM with BT by Sending 1KHz Signal					11:53:55:631 S
		"Step_2 Configuration in Signal Generator"	Step_2 Configuration in Signal Generator					11:54:07:522 S
		"Signal Genertator Initialization"	Signal Genertator Initialization					11:54:07:532 S
		"Signal Genertator Frequency Configuration"	Signal Genertator Frequency Configuration					11:54:07:542 S
		"Signal Genertator Level Configuration"	Signal Genertator Level Configuration					11:54:07:542 S
		"Signal Genertator Audio Frequency Configuration"	Signal Genertator Audio Frequency Configuration					11:54:07:552 S
		"Signal Genertator Modulation Tyep Configuration"	Signal Genertator Modulation Tyep Configuration					11:54:07:562 S
		"Step_3 Measurement in Signal Generator"	Step_3 Measurement in Signal Generator					11:54:07:572 S
		"Measuremnet in FM Signal"	Measuremnet in FM Signal					11:54:13:043 S
	Channel Left	AudioAnalyzerL	-10.73	dB	-12	-8	Ok	11:54:13:063 N
	Channel Rigth	AudioAnalyzerR	-10.57	dB	-12	-8	Ok	11:54:13:083 N
		"Measuremnet in BT Signal"	Measuremnet in BT Signal					11:54:17:343 S
	Channel Left	AudioAnalyzerL	-0.042	dB	-0.8	0.6	Ok	11:54:17:653 N
	Channel Right	AudioAnalyzerR	0.1069	dB	-0.9	0.6	Ok	11:54:17:673 N
		"Audio Analyzer RMS Configuration"	Audio Analyzer RMS Configuration					11:54:17:683 S
		"TEST - 2 Frequency Via BT"	TEST - 2 Frequency Via BT					11:54:17:963 S
		"Step_1 Low Frequency Audio Signal - 17Hz"	Step_1 Low Frequency Audio Signal - 17Hz					11:54:19:437 S
	Channel Left	AudioAnalyzerL	2.5745	dB	-3	3	Ok	11:54:23:294 N
	Channel Rigth	AudioAnalyzerR	2.719	dB	-3	3	Ok	11:54:23:524 N
		"Step_2 High Frequency Audio Signal - 19.99kHz"	Step_2 High Frequency Audio Signal - 19.99kHz					11:54:23:534 S
	Channel Left	AudioAnalyzerL	-1.528	dB	-3	3	Ok	11:54:28:025 N
	Channel Rigth	AudioAnalyzerR	-1.434	dB	-3	3	Ok	11:54:28:035 N
		"Audio Analyzer Distortion Configuration"	Audio Analyzer Distortion Configuration					11:54:28:045 S
		"TEST -3 Distortion MP3"	TEST -3 Distortion MP3					11:54:28:915 S
	Channel Left	AudioAnalyzerL	0.0412	%	0	0.1	Ok	11:54:36:376 N
	Channel Rigth	AudioAnalyzerR	0.0409	%	0	0.1	Ok	11:54:36:396 N
		"TEST - 4 Signal-to-noise ratio"	TEST - 4 Signal-to-noise ratio					11:54:36:726 S
		"Audio Track with 1kHz Signal"	Audio Track with 1kHz Signal					11:54:38:497 S
	Channel Left	AudioAnalyzerL_1kHz	0	dB				11:54:38:677 N
	Channel Rigth	AudioAnalyzerR_1kHz	0.1128	dB				11:54:38:697 N
		"Audio Track with Infinity zero"	Audio Track with Infinity zero					11:54:42:637 S
	Channel Left	AudioAnalyzerL_WithoutSignal	-81.14	dB				11:54:43:527 N
	Channel Rigth	AudioAnalyzerR_WithoutSignal	-80.28	dB				11:54:43:547 N
		SignalToNoiseRatioL	81.14	dB	70	999	Ok	11:54:43:567 N

StepID	Step Description	Expression	Evaluation Result	Unit	Lower Lim	Upper Lim	Ok	Time
		SignalToNoiseRatioR	80.3928	dB	70	999	Ok	11:54:43:577 N
		"TEST - 5 Volume Characteristics"	TEST - 5 Volume Characteristics					11:54:43:587 S
		IbWrt(AudioAnalyzer, "SENS:REF:MODE CH1S")	1					11:54:56:348 N
	Volume Step_0 Channel Left	AudioAnalyzerL	-83.36	dB	-84	-82	Ok	11:55:11:169 N
	Volume Step_0 Channel Right	AudioAnalyzerR	-83	dB	-84	-82	Ok	11:55:11:199 N
	Volume Step_1 Channel Left	AudioAnalyzerL	-78.59	dB	-80	-78	Ok	11:55:11:379 N
	Volume Step_1 Channel Right	AudioAnalyzerR	-79	dB	-80	-78	Ok	11:55:11:409 N
	Volume Step_2 Channel Left	AudioAnalyzerL	-71.34	dB	-72	-70	Ok	11:55:11:819 N
	Volume Step_2 Channel Rigth	AudioAnalyzerR	-71	dB	-72	-70	Ok	11:55:11:849 N
	Volume Step_3 Channel Left	AudioAnalyzerL	-63.51	dB	-64	-62	Ok	11:55:12:109 N
	Volume Step_3 Channel Rigth	AudioAnalyzerR	-63	dB	-64	-62	Ok	11:55:12:139 N
	Volume Step_4 Channel Left	AudioAnalyzerL	-57.5	dB	-58	-56	Ok	11:55:12:429 N
	Volume Step_4 Channel Rigth	AudioAnalyzerR	-57	dB	-58	-56	Ok	11:55:12:469 N
	Volume Step_5 Channel Left	AudioAnalyzerL	-53.47	dB	-54	-52	Ok	11:55:12:969 N
	Volume Step_5 Channel Rigth	AudioAnalyzerR	-53	dB	-54	-52	Ok	11:55:12:999 N
	Volume Step_6 Channel Left	AudioAnalyzerL	-50.46	dB	-51	-49	Ok	11:55:13:339 N
	Volume Step_6 Channel Rigth	AudioAnalyzerR	-50	dB	-51	-49	Ok	11:55:13:369 N
	Volume Step_7 Channel Left	AudioAnalyzerL	-47.98	dB	-48	-46	Ok	11:55:13:549 N
	Volume Step_7 Channel Rigth	AudioAnalyzerR	-48	dB	-48	-46	Ok	11:55:13:579 N
	Volume Step_8 Channel Left	AudioAnalyzerL	-45.46	dB	-46	-44	Ok	11:55:13:829 N
	Volume Step_8 Channel Rigth	AudioAnalyzerR	-45	dB	-46	-44	Ok	11:55:13:869 N
	Volume Step_9 Channel Left	AudioAnalyzerL	-43.87	dB	-44	-42	Ok	11:55:14:029 N
	Volume Step_9 Channel Rigth	AudioAnalyzerR	-44	dB	-44	-42	Ok	11:55:14:069 N
	Volume Step_10 Channel Left	AudioAnalyzerL	-41.57	dB	-42	-40	Ok	11:55:14:229 N

StepID	Step Description	Expression	Evaluation Result	Unit	Lower Lim	Upper Lim	Ok	Time
	Volume Step_10 Channel Rigth	AudioAnalyzerR	-41	dB	-42	-40	Ok	11:55:14:259 N
	Volume Step_11 Channel Left	AudioAnalyzerL	-39.73	dB	-40	-38	Ok	11:55:14:429 N
	Volume Step_11 Channel Rigth	AudioAnalyzerR	-40	dB	-40	-38	Ok	11:55:14:459 N
	Volume Step_12 Channel Left	AudioAnalyzerL	-37.7	dB	-38	-36	Ok	11:55:14:629 N
	Volume Step_12 Channel Rigth	AudioAnalyzerR	-38	dB	-38	-36	Ok	11:55:14:659 N
	Volume Step_13 Channel Left	AudioAnalyzerL	-35.69	dB	-36	-34	Ok	11:55:14:829 N
	Volume Step_13 Channel Rigth	AudioAnalyzerR	-36	dB	-36	-34	Ok	11:55:14:859 N
	Volume Step_14 Channel Left	AudioAnalyzerL	-34.44	dB	-35	-33	Ok	11:55:15:419 N
	Volume Step_14 Channel Rigth	AudioAnalyzerR	-34	dB	-35	-33	Ok	11:55:15:449 N
	Volume Step_15 Channel Left	AudioAnalyzerL	-32.44	dB	-33	-31	Ok	11:55:15:699 N
	Volume Step_15 Channel Rigth	AudioAnalyzerR	-32	dB	-33	-31	Ok	11:55:15:739 N
	Volume Step_16 Channel Left	AudioAnalyzerL	-31.64	dB	-32	-30	Ok	11:55:15:899 N
	Volume Step_16 Channel Rigth	AudioAnalyzerR	-32	dB	-32	-30	Ok	11:55:15:939 N
	Volume Step_17 Channel Left	AudioAnalyzerL	-30.6	dB	-31	-29	Ok	11:55:16:099 N
	Volume Step_17 Channel Rigth	AudioAnalyzerR	-30	dB	-31	-29	Ok	11:55:16:139 N
	Volume Step_18 Channel Left	AudioAnalyzerL	-29.69	dB	-30	-28	Ok	11:55:16:299 N
	Volume Step_18 Channel Rigth	AudioAnalyzerR	-30	dB	-30	-28	Ok	11:55:16:339 N
	Volume Step_19 Channel Left	AudioAnalyzerL	-28	dB	-28	-26	Ok	11:55:16:499 N
	Volume Step_19 Channel Rigth	AudioAnalyzerR	-28	dB	-28	-26	Ok	11:55:16:539 N
	Volume Step_20 Channel Left	AudioAnalyzerL	-26.6	dB	-27	-25	Ok	11:55:16:699 N
	Volume Step_20 Channel Rigth	AudioAnalyzerR	-26	dB	-27	-25	Ok	11:55:16:739 N
	Volume Step_21 Channel Left	AudioAnalyzerL	-25.61	dB	-26	-24	Ok	11:55:16:899 N

StepID	Step Description	Expression	Evaluation Result	Unit	Lower Lim	Upper Lim	Ok	Time
	Volume Step_21 Channel Rigth	AudioAnalyzerR	-25	dB	-26	-24	Ok	11:55:16:939 N
	Volume Step_22 Channel Left	AudioAnalyzerL	-23.84	dB	-24	-22	Ok	11:55:17:099 N
	Volume Step_22 Channel Rigth	AudioAnalyzerR	-24	dB	-24	-22	Ok	11:55:17:139 N
	Volume Step_23 Channel Left	AudioAnalyzerL	-22.61	dB	-23	-21	Ok	11:55:17:289 N
	Volume Step_23 Channel Rigth	AudioAnalyzerR	-22	dB	-23	-21	Ok	11:55:17:319 N
	Volume Step_24 Channel Left	AudioAnalyzerL	-21.44	dB	-22	-20	Ok	11:55:17:489 N
	Volume Step_24 Channel Rigth	AudioAnalyzerR	-21	dB	-22	-20	Ok	11:55:17:519 N
	Volume Step_25 Channel Left	AudioAnalyzerL	-19.46	dB	-20	-18	Ok	11:55:17:690 N
	Volume Step_25 Channel Rigth	AudioAnalyzerR	-19	dB	-20	-18	Ok	11:55:17:719 N
	Volume Step_26 Channel Left	AudioAnalyzerL	-18.51	dB	-19	-17	Ok	11:55:17:900 N
	Volume Step_26 Channel Rigth	AudioAnalyzerR	-18	dB	-19	-17	Ok	11:55:17:940 N
	Volume Step_27 Channel Left	AudioAnalyzerL	-17.6	dB	-18	-16	Ok	11:55:18:100 N
	Volume Step_27 Channel Rigth	AudioAnalyzerR	-17	dB	-18	-16	Ok	11:55:18:140 N
	Volume Step_28 Channel Left	AudioAnalyzerL	-15.44	dB	-16	-14	Ok	11:55:18:660 N
	Volume Step_28 Channel Rigth	AudioAnalyzerR	-15	dB	-16	-14	Ok	11:55:18:700 N
	Volume Step_29 Channel Left	AudioAnalyzerL	-14.44	dB	-15	-13	Ok	11:55:19:040 N
	Volume Step_29 Channel Rigth	AudioAnalyzerR	-14	dB	-15	-13	Ok	11:55:19:080 N
	Volume Step_30 Channel Left	AudioAnalyzerL	-13.95	dB	-14	-12	Ok	11:55:19:250 N
	Volume Step_30 Channel Rigth	AudioAnalyzerR	-14	dB	-14	-12	Ok	11:55:19:290 N
	Volume Step_31 Channel Left	AudioAnalyzerL	-12.94	dB	-13	-11	Ok	11:55:19:440 N
	Volume Step_31 Channel Rigth	AudioAnalyzerR	-13	dB	-13	-11	Ok	11:55:19:490 N
	Volume Step_32 Channel Left	AudioAnalyzerL	-10.44	dB	-11	-9	Ok	11:55:19:720 N

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StepID	Step Description	Expression	Evaluation Result	Unit	Lower Lim	Upper Lim	Ok	Time
	Volume Step_32 Channel Rigth	AudioAnalyzerR	-10	dB	-11	-9	Ok	11:55:19:750 N
	Volume Step_33 Channel Left	AudioAnalyzerL	-9.875	dB	-10	-8	Ok	11:55:19:930 N
	Volume Step_33 Channel Rigth	AudioAnalyzerR	-10	dB	-10	-8	Ok	11:55:19:970 N
	Volume Step_34 Channel Left	AudioAnalyzerL	-8.647	dB	-9	-7	Ok	11:55:20:130 N
	Volume Step_34 Channel Rigth	AudioAnalyzerR	-9	dB	-9	-7	Ok	11:55:20:170 N
	Volume Step_35 Channel Left	AudioAnalyzerL	-6.302	dB	-7	-5	Ok	11:55:20:320 N
	Volume Step_35 Channel Rigth	AudioAnalyzerR	-6	dB	-7	-5	Ok	11:55:20:370 N
	Volume Step_36 Channel Left	AudioAnalyzerL	-5.986	dB	-6	-4	Ok	11:55:20:460 N
	Volume Step_36 Channel Rigth	AudioAnalyzerR	-6	dB	-6	-4	Ok	11:55:20:500 N
	Volume Step_37 Channel Left	AudioAnalyzerL	-3.985	dB	-5	-3	Ok	11:55:20:870 N
	Volume Step_37 Channel Rigth	AudioAnalyzerR	-4	dB	-5	-3	Ok	11:55:20:910 N
	Volume Step_38 Channel Left	AudioAnalyzerL	-2.582	dB	-3	-1	Ok	11:55:21:080 N
	Volume Step_38 Channel Rigth	AudioAnalyzerR	-2	dB	-3	-1	Ok	11:55:21:120 N
	Volume Step_39 channel Left	AudioAnalyzerL	-1.458	dB	-2	0	Ok	11:55:21:300 N
	Volume Step_39 Channel Rigth	AudioAnalyzerR	-1	dB	-2	0	Ok	11:55:21:340 N
	Volume Step_40 Channel Left	AudioAnalyzerL	-0.384	dB	-1	1	Ok	11:55:21:470 N
	Volume Step_40 Channel Rigth	AudioAnalyzerR	0	dB	-1	1	Ok	11:55:21:520 N
		"TEST - 6 Channel Equality"	TEST - 6 Channel Equality					11:55:21:540 S
		"Step_1 Load in Front: FL & FR"	Step_1 Load in Front: FL & FR					11:55:33:281 S
	Channel Left	AudioAnalyzerL	-0.003	dB	-1	1	Ok	11:55:33:461 N
	Channel Rigth	AudioAnalyzerR	0.102	dB	-1	1	Ok	11:55:33:491 N
		"Step_2 Load in REAR: RL & RR"	Step_2 Load in REAR: RL & RR					11:55:33:521 S
	Channel Left	AudioAnalyzerL	0.0012	dB	-1	1	Ok	11:55:36:401 N
	Channel Rigth	AudioAnalyzerR	0.0892	dB	-1	1	Ok	11:55:36:431 N
		"TEST - 7 Channel Seperation"	TEST - 7 Channel Seperation					11:55:36:451 S
		"Step_1 Signal in Left"	Step_1 Signal in Left					11:55:36:761 S
	Channel Left	AudioAnalyzerL	0.0012	dB	-0.5	0.5	Ok	11:55:41:531 N
	Channel Rigth	AudioAnalyzerR	-76.04	dB	-80	-70	Ok	11:55:41:561 N

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StepID	Step Description	Expression	Evaluation Result	Unit	Lower Lim	Upper Lim	Ok	Time
		"Step_2 Signal in Right"	Step_2 Signal in Right					11:55:41:601 S
	Channel Left	AudioAnalyzerL	-72.49	dB	-80	-70	Ok	11:55:48:332 N
	Channel Rigth	AudioAnalyzerR	0.0002	dB	-0.5	0.5	Ok	11:55:48:372 N
		"Power OFF"	Power OFF					11:55:48:402 S
		"Testing in Under Votage V = 10.8V/Room Temperature"	Testing in Under Votage V = 10.8V/Room Temperature					11:55:51:482 S
		"Power ON"	Power ON					11:55:51:512 S
		"Audio Analyzer Initialization"	Audio Analyzer Initialization					11:55:51:552 S
		"Audio Analyzer RMS Configuration"	Audio Analyzer RMS Configuration					11:56:25:765 S
		"TEST - 2 Frequency Via BT"	TEST - 2 Frequency Via BT					11:56:26:055 S
		"Step_1 Low Frequency Audio Signal - 17Hz"	Step_1 Low Frequency Audio Signal - 17Hz					11:56:28:705 S
	Channel Left	AudioAnalyzerL	2.5648	dB	-3	3	Ok	11:56:32:836 N
	Channel Rigth	AudioAnalyzerR	2.6626	dB	-3	3	Ok	11:56:32:866 N
		"Step_2 High Frequency Audio Signal - 19.99kHz"	Step_2 High Frequency Audio Signal - 19.99kHz					11:56:32:896 S
	Channel Left	AudioAnalyzerL	-0.305	dB	-3	3	Ok	11:56:37:076 N
	Channel Rigth	AudioAnalyzerR	-0.224	dB	-3	3	Ok	11:56:37:106 N
		"Audio Analyzer Distortion Configuration"	Audio Analyzer Distortion Configuration					11:56:37:126 S
		"TEST -3 Distortion MP3"	TEST -3 Distortion MP3					11:56:38:016 S
	Channel Left	AudioAnalyzerL	0.0416	%	0	0.1	Ok	11:56:43:107 N
	Channel Rigth	AudioAnalyzerR	0.0415	%	0	0.1	Ok	11:56:43:207 N
		"TEST - 4 Signal-to-noise ratio"	TEST - 4 Signal-to-noise ratio					11:56:43:557 S
		"Audio Track with 1kHz Signal"	Audio Track with 1kHz Signal					11:57:04:988 S
	Channel Left	AudioAnalyzerL_1kHz	-1	dB				11:57:09:258 N
	Channel Rigth	AudioAnalyzerR_1kHz	-0.208	dB				11:57:18:579 N
		"Audio Track with Infinity zero"	Audio Track with Infinity zero					11:57:52:101 S
	Channel Left	AudioAnalyzerL_WithoutSignal	-80.22	dB				11:57:52:141 N
	Channel Rigth	AudioAnalyzerR_WithoutSignal	-80.5	dB				11:57:52:181 N
		SignalToNoiseRatioL	79.22	dB	70	999	Ok	11:57:52:211 N
		SignalToNoiseRatioR	80.292	dB	70	999	Ok	11:57:52:231 N
		"TEST - 6 Channel Equality"	TEST - 6 Channel Equality					11:57:52:261 S
		"Step_1 Load in Front: FL & FR"	Step_1 Load in Front: FL & FR					11:57:58:972 S
	Channel Left	AudioAnalyzerL	0.0005	dB	-1	1	Ok	11:57:59:152 N
	Channel Rigth	AudioAnalyzerR	0.0923	dB	-1	1	Ok	11:57:59:182 N
		"Step_2 Load in REAR: RL & RR"	Step_2 Load in REAR: RL & RR					11:57:59:212 S
	Channel Left	AudioAnalyzerL	0	dB	-1	1	Ok	11:58:01:453 N
	Channel Rigth	AudioAnalyzerR	0.1027	dB	-1	1	Ok	11:58:01:493 N
		"TEST - 7 Channel Seperation"	TEST - 7 Channel Seperation					11:58:01:513 S
		"Step_1 Signal in Left"	Step_1 Signal in Left					11:58:01:823 S
	Channel Left	AudioAnalyzerL	0.0001	dB	-0.5	0.5	Ok	11:58:06:013 N
	Channel Rigth	AudioAnalyzerR	-76.2	dB	-80	-70	Ok	11:58:06:153 N
		"Step_2 Signal in Right"	Step_2 Signal in Right					11:58:06:173 S
	Channel Left	AudioAnalyzerL	-72.59	dB	-80	-70	Ok	11:58:10:575 N
	Channel Rigth	AudioAnalyzerR	0.0016	dB	-0.5	0.5	Ok	11:58:10:615 N
		"Power OFF"	Power OFF					11:58:10:635 S

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StepID	Step Description	Expression	Evaluation Result	Unit	Lower Lim	Upper Lim	Ok	Time
		"Power ON"	Power ON					11:58:13:715 S
		"Audio Analyzer Initialization"	Audio Analyzer Initialization					11:58:13:745 S
		"Audio Analyzer RMS Configuration"	Audio Analyzer RMS Configuration					11:58:57:038 S
		"TEST - 2 Frequency Via BT"	TEST - 2 Frequency Via BT					11:58:57:348 S
		"Step_1 Low Frequency Audio Signal - 17Hz"	Step_1 Low Frequency Audio Signal - 17Hz					11:58:59:919 S
	Channel Left	AudioAnalyzerL	2.57	dB	-3	3	Ok	11:59:04:879 N
	Channel Rigth	AudioAnalyzerR	2.6624	dB	-3	3	Ok	11:59:04:909 N
		"Step_2 High Frequency Audio Signal - 19.99kHz"	Step_2 High Frequency Audio Signal - 19.99kHz					11:59:04:929 S
	Channel Left	AudioAnalyzerL	-2.375	dB	-3	3	Ok	11:59:09:440 N
	Channel Rigth	AudioAnalyzerR	-1.074	dB	-3	3	Ok	11:59:09:490 N
		"Audio Analyzer Distortion Configuration"	Audio Analyzer Distortion Configuration					11:59:09:510 S
		"TEST -3 Distortion MP3"	TEST -3 Distortion MP3					11:59:10:370 S
	Channel Left	AudioAnalyzerL	0.0405	%	0	0.1	Ok	11:59:15:740 N
	Channel Rigth	AudioAnalyzerR	0.0408	%	0	0.1	Ok	11:59:15:770 N
		"TEST - 4 Signal-to-noise ratio"	TEST - 4 Signal-to-noise ratio					11:59:16:110 S
		"Audio Track with 1kHz Signal"	Audio Track with 1kHz Signal					11:59:38:452 S
	Channel Left	AudioAnalyzerL_1kHz	1.003	dB				11:59:48:482 N
	Channel Rigth	AudioAnalyzerR_1kHz	1.0847	dB				11:59:58:503 N
		"Audio Track with Infinity zero"	Audio Track with Infinity zero					12:00:04:903 S
	Channel Left	AudioAnalyzerL_WithoutSignal	-79.56	dB				12:00:04:983 N
	Channel Rigth	AudioAnalyzerR_WithoutSignal	-79.77	dB				12:00:05:013 N
		SignalToNoiseRatioL	80.563	dB	70	999	Ok	12:00:05:043 N
		SignalToNoiseRatioR	80.8547	dB	70	999	Ok	12:00:05:063 N
		"TEST - 6 Channel Equality"	TEST - 6 Channel Equality					12:00:05:093 S
		"Step_1 Load in Front: FL & FR"	Step_1 Load in Front: FL & FR					12:00:32:875 S
	Channel Left	AudioAnalyzerL	-0.001	dB	-1	1	Ok	13:50:54:451 N
	Channel Rigth	AudioAnalyzerR	0.9287	dB	-1	1	Ok	12:00:50:539 N
		"Step_2 Load in REAR: RL & RR"	Step_2 Load in REAR: RL & RR					12:00:50:559 S
	Channel Left	AudioAnalyzerL	0.0010	dB	-1	1	Ok	12:00:55:191 N
	Channel Rigth	AudioAnalyzerR	0.1598	dB	-1	1	Ok	12:00:55:231 N
		"TEST - 7 Channel Seperation"	TEST - 7 Channel Seperation					12:00:55:251 S
		"Step_1 Signal in Left"	Step_1 Signal in Left					12:00:55:541 S
	Channel Left	AudioAnalyzerL	0.0007	dB	-0.5	0.5	Ok	13:51:01:933 N
	Channel Rigth	AudioAnalyzerR	-76.75	dB	-80	-70	Ok	12:01:10:495 N
		"Step_2 Signal in Right"	Step_2 Signal in Right					12:01:10:515 S
	Channel Left	AudioAnalyzerL	-72.49	dB	-80	-70	Ok	12:01:20:418 N
	Channel Rigth	AudioAnalyzerR	0.0996	dB	-0.5	0.5	Ok	12:01:20:448 N
		"Power OFF"	Power OFF					12:01:20:478 S

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StepID	Step Description	Expression	Evaluation Result	Unit	Lower Lim	Upper Lim	Ok	Time
BlauKit:5.9.13; ActiveX:5.687; User:MIA1BRG; Host:PT-D0122; Temperature:Ambient Department:BrgP/ENG-PVT; Date:25/05/2017								
		"Power ON"	Power ON					13:45:22:410 S
		Consumption	838.1518065	mA	700	900	Ok	13:45:27:811 N
		"Testing in Nominal Votage V = 13.5V/Room Temperature"	Testing in Nominal Votage V = 13.5V/Room Temperature					13:45:27:811 S
		"Audio Analyzer Initialization"	Audio Analyzer Initialization					13:45:27:811 S
		"TEST - 1 Comparing FM with BT by Sending 1KHz Signal"	TEST - 1 Comparing FM with BT by Sending 1KHz Signal					13:46:12:377 S
		"Step_2 Configuration in Signal Generator"	Step_2 Configuration in Signal Generator					13:46:16:619 S
		"Signal Genertator Initialization"	Signal Genertator Initialization					13:46:16:619 S
		"Signal Genertator Frequency Configuration"	Signal Genertator Frequency Configuration					13:46:16:629 S
		"Signal Genertator Level Configuration"	Signal Genertator Level Configuration					13:46:16:639 S
		"Signal Genertator Audio Frequency Configuration"	Signal Genertator Audio Frequency Configuration					13:46:16:649 S
		"Signal Genertator Modulation Tyep Configuration"	Signal Genertator Modulation Tyep Configuration					13:46:16:649 S
		"Step_3 Measurement in Signal Generator"	Step_3 Measurement in Signal Generator					13:46:16:669 S
		"Measuremnet in FM Signal"	Measuremnet in FM Signal					13:46:26:251 S
	Channel Left	AudioAnalyzerL	-10.79	dB	-12	-8	Ok	13:46:26:271 N
	Channel Rigth	AudioAnalyzerR	-10.64	dB	-12	-8	Ok	13:46:26:281 N
		"Measuremnet in BT Signal"	Measuremnet in BT Signal					13:46:30:702 S
	Channel Left	AudioAnalyzerL	-0.248	dB	-0.8	0.6	Ok	13:46:30:722 N
	Channel Right	AudioAnalyzerR	0.0076	dB	-0.9	0.6	Ok	13:46:30:732 N
		"Audio Analyzer RMS Configuration"	Audio Analyzer RMS Configuration					13:46:30:742 S
		"TEST - 2 Frequency Via BT"	TEST - 2 Frequency Via BT					13:46:31:012 S
		"Step_1 Low Frequency Audio Signal - 17Hz"	Step_1 Low Frequency Audio Signal - 17Hz					13:46:37:254 S
	Channel Left	AudioAnalyzerL	2.5818	dB	-3	3	Ok	13:46:47:306 N
	Channel Rigth	AudioAnalyzerR	2.7856	dB	-3	3	Ok	13:46:47:326 N
		"Step_2 High Frequency Audio Signal - 19.99kHz"	Step_2 High Frequency Audio Signal - 19.99kHz					13:46:47:326 S
	Channel Left	AudioAnalyzerL	-0.347	dB	-3	3	Ok	13:46:51:527 N
	Channel Rigth	AudioAnalyzerR	-0.154	dB	-3	3	Ok	13:46:51:547 N
		"Audio Analyzer Distortion Configuration"	Audio Analyzer Distortion Configuration					13:46:51:557 S
		"TEST -3 Distortion MP3"	TEST -3 Distortion MP3					13:46:52:477 S
	Channel Left	AudioAnalyzerL	0.0901	%	0	0.1	Ok	13:46:56:978 N
	Channel Rigth	AudioAnalyzerR	0.0905	%	0	0.1	Ok	13:46:56:998 N
		"TEST - 4 Signal-to-noise ratio"	TEST - 4 Signal-to-noise ratio					13:46:57:338 S
		"Audio Track with 1kHz Signal"	Audio Track with 1kHz Signal					13:46:58:668 S
	Channel Left	AudioAnalyzerL_1kHz	0	dB				13:46:58:838 N
	Channel Rigth	AudioAnalyzerR_1kHz	0.2228	dB				13:46:58:858 N
		"Audio Track with Infinity zero"	Audio Track with Infinity zero					13:47:02:760 S
	Channel Left	AudioAnalyzerL_WithoutSignal	-80.82	dB				13:47:03:350 N
	Channel Rigth	AudioAnalyzerR_WithoutSignal	-79.38	dB				13:47:03:420 N
		SignalToNoiseRatioL	80.82	dB	70	999	Ok	13:47:03:440 N

StepID	Step Description	Expression	Evaluation Result	Unit	Lower Lim	Upper Lim	Ok	Time
		SignalToNoiseRatioR	79.6028	dB	70	999	Ok	13:47:03:450 N
		"TEST - 5 Volume Characteristics"	TEST - 5 Volume Characteristics					13:47:03:460 S
	Volume Step_0 Channel Left	AudioAnalyzerL	-83.38	dB	-84	-82	Ok	13:47:30:994 N
	Volume Step_0 Channel Right	AudioAnalyzerR	-83	dB	-84	-82	Ok	13:47:31:014 N
	Volume Step_1 Channel Left	AudioAnalyzerL	-78.6	dB	-80	-78	Ok	13:47:31:874 N
	Volume Step_1 Channel Right	AudioAnalyzerR	-78	dB	-80	-78	Ok	13:47:31:904 N
	Volume Step_2 Channel Left	AudioAnalyzerL	-71.51	dB	-72	-70	Ok	13:47:32:154 N
	Volume Step_2 Channel Rigth	AudioAnalyzerR	-71	dB	-72	-70	Ok	13:47:32:184 N
	Volume Step_3 Channel Left	AudioAnalyzerL	-63.47	dB	-64	-62	Ok	13:47:32:474 N
	Volume Step_3 Channel Rigth	AudioAnalyzerR	-63	dB	-64	-62	Ok	13:47:32:514 N
	Volume Step_4 Channel Left	AudioAnalyzerL	-57.47	dB	-58	-56	Ok	13:47:32:754 N
	Volume Step_4 Channel Rigth	AudioAnalyzerR	-57	dB	-58	-56	Ok	13:47:32:784 N
	Volume Step_5 Channel Left	AudioAnalyzerL	-53.47	dB	-54	-52	Ok	13:47:33:314 N
	Volume Step_5 Channel Rigth	AudioAnalyzerR	-53	dB	-54	-52	Ok	13:47:33:344 N
	Volume Step_6 Channel Left	AudioAnalyzerL	-50.44	dB	-51	-49	Ok	13:47:33:594 N
	Volume Step_6 Channel Rigth	AudioAnalyzerR	-50	dB	-51	-49	Ok	13:47:33:624 N
	Volume Step_7 Channel Left	AudioAnalyzerL	-47.45	dB	-48	-46	Ok	13:47:34:064 N
	Volume Step_7 Channel Rigth	AudioAnalyzerR	-47	dB	-48	-46	Ok	13:47:34:104 N
	Volume Step_8 Channel Left	AudioAnalyzerL	-45.44	dB	-46	-44	Ok	13:47:34:344 N
	Volume Step_8 Channel Rigth	AudioAnalyzerR	-45	dB	-46	-44	Ok	13:47:34:374 N
	Volume Step_9 Channel Left	AudioAnalyzerL	-43.75	dB	-44	-42	Ok	13:47:34:554 N
	Volume Step_9 Channel Rigth	AudioAnalyzerR	-44	dB	-44	-42	Ok	13:47:34:584 N
	Volume Step_10 Channel Left	AudioAnalyzerL	-41.65	dB	-42	-40	Ok	13:47:34:744 N

StepID	Step Description	Expression	Evaluation Result	Unit	Lower Lim	Upper Lim	Ok	Time
	Volume Step_10 Channel Rigth	AudioAnalyzerR	-41	dB	-42	-40	Ok	13:47:34:784 N
	Volume Step_11 Channel Left	AudioAnalyzerL	-39.79	dB	-40	-38	Ok	13:47:34:944 N
	Volume Step_11 Channel Rigth	AudioAnalyzerR	-40	dB	-40	-38	Ok	13:47:34:985 N
	Volume Step_12 Channel Left	AudioAnalyzerL	-37.78	dB	-38	-36	Ok	13:47:35:145 N
	Volume Step_12 Channel Rigth	AudioAnalyzerR	-38	dB	-38	-36	Ok	13:47:35:185 N
	Volume Step_13 Channel Left	AudioAnalyzerL	-35.77	dB	-36	-34	Ok	13:47:35:345 N
	Volume Step_13 Channel Rigth	AudioAnalyzerR	-36	dB	-36	-34	Ok	13:47:35:385 N
	Volume Step_14 Channel Left	AudioAnalyzerL	-34.57	dB	-35	-33	Ok	13:47:35:545 N
	Volume Step_14 Channel Rigth	AudioAnalyzerR	-34	dB	-35	-33	Ok	13:47:35:915 N
	Volume Step_15 Channel Left	AudioAnalyzerL	-32.63	dB	-33	-31	Ok	13:47:36:115 N
	Volume Step_15 Channel Rigth	AudioAnalyzerR	-32	dB	-33	-31	Ok	13:47:36:155 N
	Volume Step_16 Channel Left	AudioAnalyzerL	-31.83	dB	-32	-30	Ok	13:47:36:325 N
	Volume Step_16 Channel Rigth	AudioAnalyzerR	-32	dB	-32	-30	Ok	13:47:36:365 N
	Volume Step_17 Channel Left	AudioAnalyzerL	-30.43	dB	-31	-29	Ok	13:47:36:875 N
	Volume Step_17 Channel Rigth	AudioAnalyzerR	-30	dB	-31	-29	Ok	13:47:36:915 N
	Volume Step_18 Channel Left	AudioAnalyzerL	-29.79	dB	-30	-28	Ok	13:47:37:085 N
	Volume Step_18 Channel Rigth	AudioAnalyzerR	-30	dB	-30	-28	Ok	13:47:37:125 N
	Volume Step_19 Channel Left	AudioAnalyzerL	-27.43	dB	-28	-26	Ok	13:47:37:355 N
	Volume Step_19 Channel Rigth	AudioAnalyzerR	-27	dB	-28	-26	Ok	13:47:37:395 N
	Volume Step_20 Channel Left	AudioAnalyzerL	-26.6	dB	-27	-25	Ok	13:47:37:555 N
	Volume Step_20 Channel Rigth	AudioAnalyzerR	-26	dB	-27	-25	Ok	13:47:37:605 N
	Volume Step_21 Channel Left	AudioAnalyzerL	-25.6	dB	-26	-24	Ok	13:47:37:765 N

StepID	Step Description	Expression	Evaluation Result	Unit	Lower Lim	Upper Lim	Ok	Time
	Volume Step_21 Channel Rigth	AudioAnalyzerR	-25	dB	-26	-24	Ok	13:47:37:805 N
	Volume Step_22 Channel Left	AudioAnalyzerL	-23.43	dB	-24	-22	Ok	13:47:38:075 N
	Volume Step_22 Channel Rigth	AudioAnalyzerR	-23	dB	-24	-22	Ok	13:47:38:115 N
	Volume Step_23 Channel Left	AudioAnalyzerL	-22.79	dB	-23	-21	Ok	13:47:38:275 N
	Volume Step_23 Channel Rigth	AudioAnalyzerR	-23	dB	-23	-21	Ok	13:47:38:305 N
	Volume Step_24 Channel Left	AudioAnalyzerL	-21.6	dB	-22	-20	Ok	13:47:38:475 N
	Volume Step_24 Channel Rigth	AudioAnalyzerR	-21	dB	-22	-20	Ok	13:47:38:505 N
	Volume Step_25 Channel Left	AudioAnalyzerL	-19.94	dB	-20	-18	Ok	13:47:38:675 N
	Volume Step_25 Channel Rigth	AudioAnalyzerR	-20	dB	-20	-18	Ok	13:47:38:705 N
	Volume Step_26 Channel Left	AudioAnalyzerL	-18.71	dB	-19	-17	Ok	13:47:38:885 N
	Volume Step_26 Channel Rigth	AudioAnalyzerR	-19	dB	-19	-17	Ok	13:47:38:925 N
	Volume Step_27 Channel Left	AudioAnalyzerL	-17.9	dB	-18	-16	Ok	13:47:39:085 N
	Volume Step_27 Channel Rigth	AudioAnalyzerR	-18	dB	-18	-16	Ok	13:47:39:135 N
	Volume Step_28 Channel Left	AudioAnalyzerL	-15.43	dB	-16	-14	Ok	13:47:39:645 N
	Volume Step_28 Channel Rigth	AudioAnalyzerR	-15	dB	-16	-14	Ok	13:47:39:685 N
	Volume Step_29 Channel Left	AudioAnalyzerL	-14.86	dB	-15	-13	Ok	13:47:39:855 N
	Volume Step_29 Channel Rigth	AudioAnalyzerR	-15	dB	-15	-13	Ok	13:47:39:895 N
	Volume Step_30 Channel Left	AudioAnalyzerL	-13.87	dB	-14	-12	Ok	13:47:40:045 N
	Volume Step_30 Channel Rigth	AudioAnalyzerR	-14	dB	-14	-12	Ok	13:47:40:085 N
	Volume Step_31 Channel Left	AudioAnalyzerL	-12.84	dB	-13	-11	Ok	13:47:40:245 N
	Volume Step_31 Channel Rigth	AudioAnalyzerR	-13	dB	-13	-11	Ok	13:47:40:285 N
	Volume Step_32 Channel Left	AudioAnalyzerL	-10.43	dB	-11	-9	Ok	13:47:40:785 N

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StepID	Step Description	Expression	Evaluation Result	Unit	Lower Lim	Upper Lim	Ok	Time
	Volume Step_32 Channel Rigth	AudioAnalyzerR	-10	dB	-11	-9	Ok	13:47:40:815 N
	Volume Step_33 Channel Left	AudioAnalyzerL	-9.7	dB	-10	-8	Ok	13:47:40:995 N
	Volume Step_33 Channel Rigth	AudioAnalyzerR	-10	dB	-10	-8	Ok	13:47:41:035 N
	Volume Step_34 Channel Left	AudioAnalyzerL	-8.894	dB	-9	-7	Ok	13:47:41:195 N
	Volume Step_34 Channel Rigth	AudioAnalyzerR	-9	dB	-9	-7	Ok	13:47:41:235 N
	Volume Step_35 Channel Left	AudioAnalyzerL	-6.881	dB	-7	-5	Ok	13:47:41:395 N
	Volume Step_35 Channel Rigth	AudioAnalyzerR	-7	dB	-7	-5	Ok	13:47:41:435 N
	Volume Step_36 Channel Left	AudioAnalyzerL	-5.975	dB	-6	-4	Ok	13:47:41:535 N
	Volume Step_36 Channel Rigth	AudioAnalyzerR	-5	dB	-6	-4	Ok	13:47:41:595 N
	Volume Step_37 Channel Left	AudioAnalyzerL	-4.819	dB	-5	-3	Ok	13:47:41:685 N
	Volume Step_37 Channel Rigth	AudioAnalyzerR	-5	dB	-5	-3	Ok	13:47:41:725 N
	Volume Step_38 Channel Left	AudioAnalyzerL	-2.778	dB	-3	-1	Ok	13:47:41:875 N
	Volume Step_38 Channel Rigth	AudioAnalyzerR	-3	dB	-3	-1	Ok	13:47:41:915 N
	Volume Step_39 channel Left	AudioAnalyzerL	-1.393	dB	-2	0	Ok	13:47:42:095 N
	Volume Step_39 Channel Rigth	AudioAnalyzerR	-1	dB	-2	0	Ok	13:47:42:135 N
	Volume Step_40 Channel Left	AudioAnalyzerL	-0.457	dB	-1	1	Ok	13:47:42:275 N
	Volume Step_40 Channel Rigth	AudioAnalyzerR	0	dB	-1	1	Ok	13:47:42:325 N
		"TEST - 6 Channel Equality"	TEST - 6 Channel Equality					13:47:42:345 S
		"Step_1 Load in Front: FL & FR"	Step_1 Load in Front: FL & FR					13:48:00:558 S
	Channel Left	AudioAnalyzerL	-0.001	dB	-1	1	Ok	13:48:00:738 N
	Channel Rigth	AudioAnalyzerR	0.1134	dB	-1	1	Ok	13:48:00:768 N
		"Step_2 Load in REAR: RL & RR"	Step_2 Load in REAR: RL & RR					13:48:00:798 S
	Channel Left	AudioAnalyzerL	-0.002	dB	-1	1	Ok	13:48:04:239 N
	Channel Rigth	AudioAnalyzerR	0.2342	dB	-1	1	Ok	13:48:04:269 N
		"TEST - 7 Channel Seperation"	TEST - 7 Channel Seperation					13:48:04:299 S
		"Step_1 Signal in Left"	Step_1 Signal in Left					13:48:04:609 S
	Channel Left	AudioAnalyzerL	-0.001	dB	-0.5	0.5	Ok	13:48:11:461 N
	Channel Rigth	AudioAnalyzerR	-76.26	dB	-80	-70	Ok	13:48:11:721 N

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BOSCH

StepID	Step Description	Expression	Evaluation Result	Unit	Lower Lim	Upper Lim	Ok	Time
		"Step_2 Signal in Right"	Step_2 Signal in Right					13:48:11:751 S
	Channel Left	AudioAnalyzerL	-72.78	dB	-80	-70	Ok	13:48:16:562 N
	Channel Rigth	AudioAnalyzerR	0.0006	dB	-0.5	0.5	Ok	13:48:16:602 N
		"Power OFF"	Power OFF					13:48:16:632 S
		"Testing in Under Votage V = 10.8V/Room Temperature"	Testing in Under Votage V = 10.8V/Room Temperature					13:48:19:712 S
		"Power ON"	Power ON					13:48:19:742 S
		"Audio Analyzer Initialization"	Audio Analyzer Initialization					13:48:19:782 S
		"Audio Analyzer RMS Configuration"	Audio Analyzer RMS Configuration					13:48:54:906 S
		"TEST - 2 Frequency Via BT"	TEST - 2 Frequency Via BT					13:48:55:216 S
		"Step_1 Low Frequency Audio Signal - 17Hz"	Step_1 Low Frequency Audio Signal - 17Hz					13:48:57:507 S
	Channel Left	AudioAnalyzerL	2.5827	dB	-3	3	Ok	13:49:03:018 N
	Channel Rigth	AudioAnalyzerR	2.7731	dB	-3	3	Ok	13:49:03:048 N
		"Step_2 High Frequency Audio Signal - 19.99kHz"	Step_2 High Frequency Audio Signal - 19.99kHz					13:49:03:078 S
	Channel Left	AudioAnalyzerL	2.6854	dB	-3	3	Ok	13:49:07:530 N
	Channel Rigth	AudioAnalyzerR	2.8715	dB	-3	3	Ok	13:49:07:560 N
		"Audio Analyzer Distortion Configuration"	Audio Analyzer Distortion Configuration					13:49:07:580 S
		"TEST -3 Distortion MP3"	TEST -3 Distortion MP3					13:49:08:540 S
	Channel Left	AudioAnalyzerL	0.0828	%	0	0.1	Ok	13:49:13:371 N
	Channel Rigth	AudioAnalyzerR	0.083	%	0	0.1	Ok	13:49:13:401 N
		"TEST - 4 Signal-to-noise ratio"	TEST - 4 Signal-to-noise ratio					13:49:13:761 S
		"Audio Track with 1kHz Signal"	Audio Track with 1kHz Signal					13:49:15:076 S
	Channel Left	AudioAnalyzerL_1kHz	0.001	dB				13:49:15:251 N
	Channel Rigth	AudioAnalyzerR_1kHz	0.1926	dB				13:49:15:281 N
		"Audio Track with Infinity zero"	Audio Track with Infinity zero					13:49:24:573 S
	Channel Left	AudioAnalyzerL_WithoutSignal	-80.91	dB				13:49:24:613 N
	Channel Rigth	AudioAnalyzerR_WithoutSignal	-80.82	dB				13:49:24:643 N
		SignalToNoiseRatioL	80.911	dB	70	999	Ok	13:49:24:663 N
		SignalToNoiseRatioR	81.0126	dB	70	999	Ok	13:49:24:683 N
		"TEST - 6 Channel Equality"	TEST - 6 Channel Equality					13:49:24:713 S
		"Step_1 Load in Front: FL & FR"	Step_1 Load in Front: FL & FR					13:49:31:394 S
	Channel Left	AudioAnalyzerL	0.0002	dB	-1	1	Ok	13:49:31:574 N
	Channel Rigth	AudioAnalyzerR	0.1936	dB	-1	1	Ok	13:49:31:604 N
		"Step_2 Load in REAR: RL & RR"	Step_2 Load in REAR: RL & RR					13:49:31:624 S
	Channel Left	AudioAnalyzerL	0.001	dB	-1	1	Ok	13:49:33:775 N
	Channel Rigth	AudioAnalyzerR	0.2328	dB	-1	1	Ok	13:49:33:815 N
		"TEST - 7 Channel Seperation"	TEST - 7 Channel Seperation					13:49:33:845 S
		"Step_1 Signal in Left"	Step_1 Signal in Left					13:49:34:155 S
	Channel Left	AudioAnalyzerL	0.0004	dB	-0.5	0.5	Ok	13:49:40:876 N
	Channel Rigth	AudioAnalyzerR	-76.51	dB	-80	-70	Ok	13:49:41:386 N
		"Step_2 Signal in Right"	Step_2 Signal in Right					13:49:41:406 S
	Channel Left	AudioAnalyzerL	-72.43	dB	-80	-70	Ok	13:49:46:690 N
	Channel Rigth	AudioAnalyzerR	0.0007	dB	-0.5	0.5	Ok	13:49:46:720 N
		"Power OFF"	Power OFF					13:49:46:750 S

BlauKit Report

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StepID	Step Description	Expression	Evaluation Result	Unit	Lower Lim	Upper Lim	Ok	Time
		"Power ON"	Power ON					13:49:49:820 S
		"Audio Analyzer Initialization"	Audio Analyzer Initialization					13:49:49:850 S
		"Audio Analyzer RMS Configuration"	Audio Analyzer RMS Configuration					13:50:21:723 S
		"TEST - 2 Frequency Via BT"	TEST - 2 Frequency Via BT					13:50:22:023 S
		"Step_1 Low Frequency Audio Signal - 17Hz"	Step_1 Low Frequency Audio Signal - 17Hz					13:50:24:465 S
	Channel Left	AudioAnalyzerL	2.5775	dB	-3	3	Ok	13:50:28:326 N
	Channel Rigth	AudioAnalyzerR	2.7873	dB	-3	3	Ok	13:50:28:356 N
		"Step_2 High Frequency Audio Signal - 19.99kHz"	Step_2 High Frequency Audio Signal - 19.99kHz					13:50:28:376 S
	Channel Left	AudioAnalyzerL	-1.102	dB	-3	3	Ok	13:50:32:737 N
	Channel Rigth	AudioAnalyzerR	-0.924	dB	-3	3	Ok	13:50:32:767 N
		"Audio Analyzer Distortion Configuration"	Audio Analyzer Distortion Configuration					13:50:32:797 S
		"TEST -3 Distortion MP3"	TEST -3 Distortion MP3					13:50:33:727 S
	Channel Left	AudioAnalyzerL	0.0402	%	0	0.1	Ok	13:50:39:068 N
	Channel Rigth	AudioAnalyzerR	0.04	%	0	0.1	Ok	13:50:39:098 N
		"TEST - 4 Signal-to-noise ratio"	TEST - 4 Signal-to-noise ratio					13:50:39:448 S
		"Audio Track with 1kHz Signal"	Audio Track with 1kHz Signal					13:50:43:309 S
	Channel Left	AudioAnalyzerL_1kHz	0.0007	dB				13:50:43:489 N
	Channel Rigth	AudioAnalyzerR_1kHz	0.2014	dB				13:50:43:519 N
		"Audio Track with Infinity zero"	Audio Track with Infinity zero					13:50:48:610 S
	Channel Left	AudioAnalyzerL_WithoutSignal	-80.47	dB				13:50:48:750 N
	Channel Rigth	AudioAnalyzerR_WithoutSignal	-80.66	dB				13:50:48:780 N
		SignalToNoiseRatioL	80.4707	dB	70	999	Ok	13:50:48:810 N
		SignalToNoiseRatioR	80.8614	dB	70	999	Ok	13:50:48:840 N
		"TEST - 6 Channel Equality"	TEST - 6 Channel Equality					13:50:48:860 S
		"Step_1 Load in Front: FL & FR"	Step_1 Load in Front: FL & FR					13:50:54:281 S
	Channel Left	AudioAnalyzerL	-0.001	dB	-1	1	Ok	13:50:54:451 N
	Channel Rigth	AudioAnalyzerR	0.1914	dB	-1	1	Ok	13:50:54:591 N
		"Step_2 Load in REAR: RL & RR"	Step_2 Load in REAR: RL & RR					13:50:54:611 S
	Channel Left	AudioAnalyzerL	0	dB	-1	1	Ok	13:50:56:454 N
	Channel Rigth	AudioAnalyzerR	0.2265	dB	-1	1	Ok	13:50:56:482 N
		"TEST - 7 Channel Seperation"	TEST - 7 Channel Seperation					13:50:56:505 S
		"Step_1 Signal in Left"	Step_1 Signal in Left					13:50:56:802 S
	Channel Left	AudioAnalyzerL	0.0004	dB	-0.5	0.5	Ok	13:51:01:933 N
	Channel Rigth	AudioAnalyzerR	-75.86	dB	-80	-70	Ok	13:51:01:963 N
		"Step_2 Signal in Right"	Step_2 Signal in Right					13:51:01:983 S
	Channel Left	AudioAnalyzerL	-72.91	dB	-80	-70	Ok	13:51:07:434 N
	Channel Rigth	AudioAnalyzerR	0.0003	dB	-0.5	0.5	Ok	13:51:07:464 N
		"Power OFF"	Power OFF					13:51:07:494 S