Prüfbericht-Nr.: *Test Report No.*:	**50304063 001**	**Auftrags-Nr.:** *Order No.*:	238105155	Seite 1 von 41 *Page 1 of 41*
Kunden-Referenz-Nr.: *Client Reference No.*:	N/A	**Auftragsdatum:** *Order date*:	14-Jun-2019	
Auftraggeber: *Client*:	Bang & Olufsen A/S Bang og Olufsen Allé 1, 7600 Struer, Denmark			
Prüfgegenstand: *Test item*:	Bluetooth Earphone			
Bezeichnung / Typ-Nr.: *Identification / Type No.*:	E8 3rd Gen Earbud L			
Auftrags-Inhalt: *Order content*:	FCC Part 15C / ISED RSS-247 Test report			
Prüfgrundlage: *Test specification*:	FCC 47CFR Part 15: Subpart C Section 15.247(DTS) ISED RSS-247 (02-2017)			

Wareneingangsdatum: *Date of receipt*:	09-Sep-2019
Prüfmuster-Nr.: *Test sample No.*:	A000987830-005 A000987830-006
Prüfzeitraum: *Testing period*:	25-Sep-2019 – 04-Oct-2019
Ort der Prüfung: *Place of testing*:	EMC/RF Laboratory Taipei
Prüflaboratorium: *Testing laboratory*:	TUV Rheinland Taiwan Ltd.
Prüfergebnis*: *Test result**:	Pass

Report date / *tested by*:

23-Oct-2019 Mars Y.J. Lin/Project Engineer

Datum *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*

kontrolliert von / *reviewed by*:

23-Oct-2019 Arvin Ho/Vice General Manager

Datum *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*

Sonstiges / *Other*:

Zustand des Prüfgegenstandes bei Anlieferung:
Condition of the test item at delivery: Prüfmuster vollständig und unbeschädigt
Test item complete and undamaged

* Legende:	1 = sehr gut	2 = gut	3 = befriedigend	4 = ausreichend	5 = mangelhaft
	P(ass) = entspricht o.g. Prüfgrundlage(n)		F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
Legend:	*1 = very good*	*2 = good*	*3 = satisfactory*	*4 = sufficient*	*5 = poor*
	P(ass) = passed a.m. test specification(s)		*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

V04

TEST SUMMARY

5.1.1 ANTENNA REQUIREMENT
RESULT: Passed

5.1.2 MAXIMUM CONDUCTED PEAK OUTPUT POWER
RESULT: Passed

5.1.3 6DB BANDWIDTH AND 99% BANDWIDTH
RESULT: Passed

5.1.4 POWER DENSITY
RESULT: Passed

5.1.5 CONDUCTED SPURIOUS EMISSIONS AND FREQUENCY BAND EDGE MEASURED IN 100KHZ BANDWIDTH
RESULT: Passed

5.1.6 SPURIOUS EMISSION
RESULT: Passed

6.1.1 ELECTROMAGNETIC FIELDS
RESULT: Passed

Contents

1. General Remarks

1.1 Complementary Materials

The following attachments are integral parts of this test report:

Appendix P: Photo Documentation internal view
(File Name: 50304063 001 APPENDIXP)

Appendix D: Test Result of Radiated Emissions
(File Name: 50304063 001 APPENDIXD)

Test Specifications

The following standards were applied.

Table 1: Applied Standard and Test Levels

Radio
FCC 47CFR Part 15: Subpart C Section 15.247
FCC 47CFR Part 2: Subpart J Section 2.1091
ISED RSS-247 Issue 2, Feb 2017
ISED RSS-102 Issue 5, March 2015
ISED RSS-Gen, Issue 5, March 2019
ANSI C63.10:2013
KDB558074 D01 DTS Meas Guidance v05r02
KDB447498 D01 General RF Exposure Guidance v06

1.2 Decision Rule of conformity

The decision rule of conformity of this test report is following the requirements of the requested standard in the quotation, and agreed among testing laboratory and manufacturer (applicant) to exclude the consideration of Measurement Uncertainty, unless it is required by the specific standard.

2. Test Sites

2.1 Test Laboratory

TUV Rheinland Taiwan Ltd.
Taipei Testing Laboratories

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)

2.2 Test Facility

TUV Rheinland Taiwan Ltd.

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)

FCC RegistrationNo.: 180491
IC Canada Registration No.: 9465A
TAF Accredited NCC Test Lab. No.:3567
TAF ISO17025 Certification effective period: 6th-May-2019 to 05th-May-2022

Testing Laboratory
3567

2.3 List of Test and Measurement Instruments

Table 2: List of Test and Measurement Equipment

Kind of Equipment	Manu-facturer	Type	S/N	Last Calibration	Next Calibration
Test Software	Audix	e3	Ver.9	N/A	N/A
EMI Test Receiver	R&S	ESR 7	101549	2018/11/12	2019/11/10
Spectrum Analyzer	R&S	FSV 40	100921	2019/04/30	2020/04/30
Preamplifier (30MHz -1GHz)	Hewlett Packard	8447D	2944A06641	2019/01/08	2020/01/08
Preamplifier (18 GHz -40 GHz)	EMC Instruments	EMC184045SE	980652	2019/02/25	2020/02/25
Pre-Amplifier (1GHz~18GHz)	EM Electronics	EM01G18G	60649	2019/09/11	2020/09/11
Bilog Antenna	TESEQ	CBL 6111D	29804	2019/07/12	2020/07/12
Horn Antenna	ETS-Lindgren	3117	218931	2018/12/27	2019/12/27
Horn Antenna (18GHz~40GHz)	COM-POWER	AH-840	101029	2018/12/22	2019/12/22
Loop Antenna	Schwarzbeck	FMZB 1513	1513-076	2019/07/11	2020/07/11
power Meter	Anritsu	ML2495A	1901008	2019/04/29	2020/04/28
Power Sensor	Anritsu	MA2411B	1725269	2019/04/29	2020/04/28

2.4 Traceability

All measurement equipment calibrations are traceable to NML(Taiwan)/NIST(USA) or where calibration is performed outside Taiwan, to equivalent nationally recognized standards organizations.

2.5 Calibration

Equipment requiring calibration is calibrated periodically in a suitably accredited Calibration Lab. Additionally all equipment is verified for proper performance on a regular schedule using in house standards or comparisons.

2.6 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements .

Table 3: Emission Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	± 1 x 10^{-7}
RF power, conducted	± 1.5 dB
RF power density, conducted	± 3 dB
spurious emissions, conducted	± 3 dB
all emissions, radiated	± 6 dB
Temperature	± 1 ºC
Humidity	± 5 %

3. General Product Information

3.1 Product Function and Intended Use

The EUT is a Bluetooth Earphone. It contains a bluetooth compatible module enabling the user to communicate data through a Wireless interface.

For details refer to the User Guide, Data Sheet and Circuit Diagram.

3.2 System Details and Ratings

Table 4: Basic Information of EUT

Item	EUT information
Kind of Equipment/Test Item	Bluetooth Earphone
Type Designation	E8 3rd Gen Earbud L
FCC ID	TTUBEOPLAYE8L3
IC	3775B-BEOPLAYE8L3
HVIN	E8 3rd Gen Earbud L

Table 5: Technical Specification of EUT

Technical Specification	Value
Operating Frequencies	2402~2480MHz
Channel number	40
Operation Voltage	5Vdc
Modulation	GFSK
Antenna gain	-0.2dBi

3.3 Independent Operation Modes

Basic operation modes are:

A. Transmitting
    1. Low channel
    2. Middle channel
    3. High channel
B. Receiving
C. Standby
D. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.5 Submitted Documents

- Circuit Diagram
- Blocking Diagram
- Rating Label
- Technical Description

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The equipment under test (EUT) was configured to measure its maximum power level. The test modes were adapted accordingly in reference to the instructions for use.

During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Table 6: Table for Parameters of Test Software Setting

Mode	Channel Frequency		
	2402 MHz	2440 MHz	2480 MHz
1M	Default	Default	Default
2M	Default	Default	Default

4.2 Test Operation and Test Software

Setup for testing: The module is mounted on an Evaluation Board provided by the manufacturer. The EVB is provided with an USB-UART interface which makes it possible to control the module through the test software installed on a notebook computer.

This software was running on the laptop computer connected to the EUT. It was used to enable the operation modes listed in section 3.3 as appropriate.

The samples were used as follows:
Conducted sample: A000987830-005
Radiation sample: A000987830-006

Full test was applied on all test modes, but only worst case was shown

Test Software	Bluesuite 3.2.2.144

4.3 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

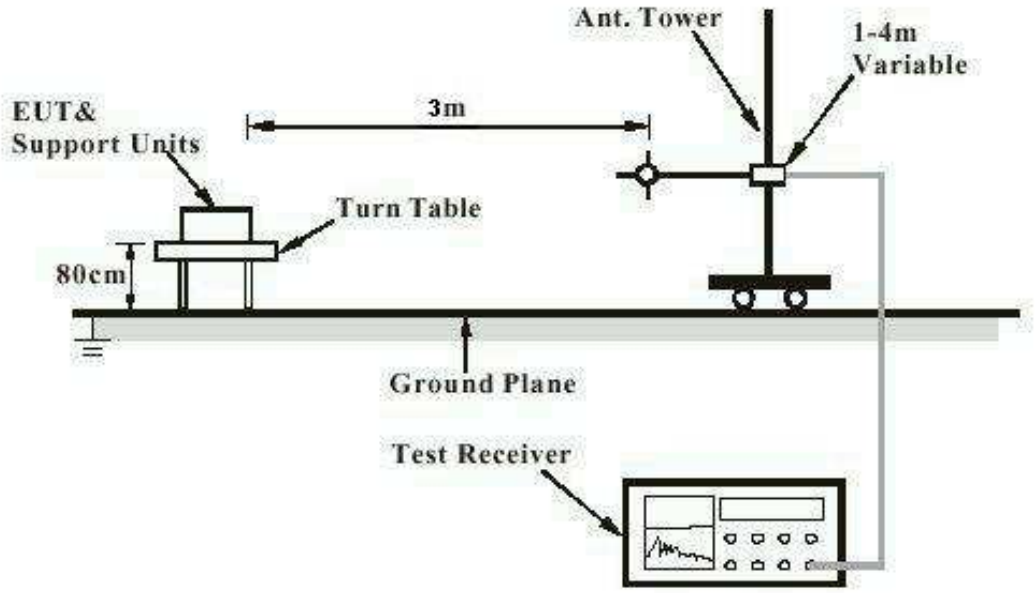
Description	Manufacturer	Model No.	Serial No.
Notebook(EMC-06)	Lenovo	TP00048A	PB-0F8B2

4.4 Countermeasures to achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Constructional Data Form or the Technical Construction File. No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



Note: Measurements above 1 GHz are done with a table height of 1.5m

Diagram of Measurement Equipment Configuration for Mains Conduction Measurement (if applicable)

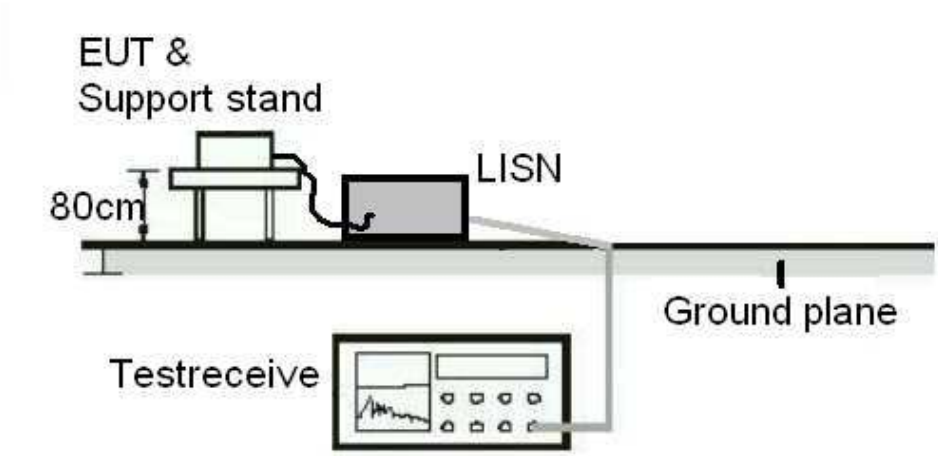
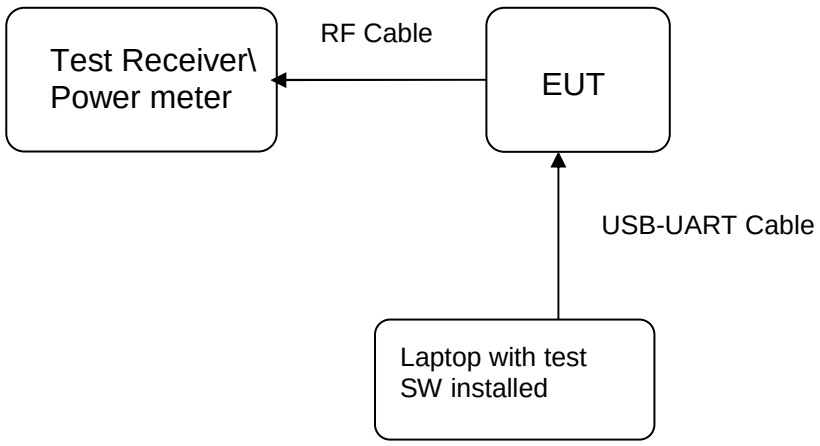


Diagram of Measurement Equipment Configuration for Conducted Transmitter Measurement



5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT: **Passed**

Test standard	:	FCC Part 15.247(b)(4), Part 15.203 and RSS-Gen 6.8
Requirement	:	use of approved antennas only with directional gains that do not exceed 6 dBi

According to the manufacturer declaration, the EUT has an antenna with Max directional gain of -0.2dBi. The antenna is a printed PCB trace with no possibility of replacement with a non-approved antenna by the end-user. Therefore, the EUT is considered to comply with this provision.

Refer to EUT photo for details.

5.1.2 Maximum conducted Peak output power

RESULT: **Passed**

Test standard	:	FCC Part 15.247(b)(3), RSS-247 5.4(b)
Basic standard	:	ANSI C63.10:2013, KDB558074
Limit	:	1 Watt
Kind of test site	:	Shielded room

Test setup

Test Channel	:	Low/ Middle/ High
Operation Mode	:	A
Ambient temperature	:	20-24 °C
Relative humidity	:	50-65 %
Atmospheric pressure	:	100-103 kPa

Table 7: Test result of Maximum conducted Peak output power, LE 1M

Channel	Channel Frequency (MHz)	Output Power		Average Power	Limit
		(dBm)	(W)	(dBm)	(W)
Low Channel	2402	7.25	0.00531	7.14	1
Middle Channel	2440	7.19	0.00524	7.06	1
High Channel	2480	7.02	0.00504	6.9	1

Table 8: Test result of Maximum conducted Peak output power, LE 2M

Channel	Channel Frequency (MHz)	Output Power		Average Power	Limit
		(dBm)	(W)	dBm)	(W)
Low Channel	2402	7.25	0.00531	7.14	1
Middle Channel	2440	7.18	0.00522	7.07	1
High Channel	2480	7.05	0.00507	6.91	1

5.1.3 6dB Bandwidth and 99% Bandwidth

RESULT: **Passed**

Test standard	:	FCC Part 15.247(a)(2), RSS-247 5.2(a) RSS-Gen (Issue 5) 6.7
Basic standard	:	ANSI C63.10:2013, KDB558074
Kind of test site	:	Shielded room

Test setup

Test Channel	:	Low/ Middle/ High
Operation Mode	:	A

Ambient temperature	:	20-24°C
Relative humidity	:	50-65%
Atmospheric pressure	:	100-103 kPa

Table 9: Test result of 6dB Bandwidth, LE 1M

Channel	Channel Frequency (MHz)	6dB Bandwidth (kHz)	Limit (kHz)	Result
Low Channel	2402	729.4	>500	Pass
Mid Channel	2440	733.7	>500	Pass
High Channel	2480	733.7	>500	Pass

Table 10: Test result of 6dB Bandwidth, LE 2M

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Low Channel	2402	1.262	>500	Pass
Mid Channel	2440	1.288	>500	Pass
High Channel	2480	1.266	>500	Pass

Table 11: Test result of 99% Bandwidth, LE 1M

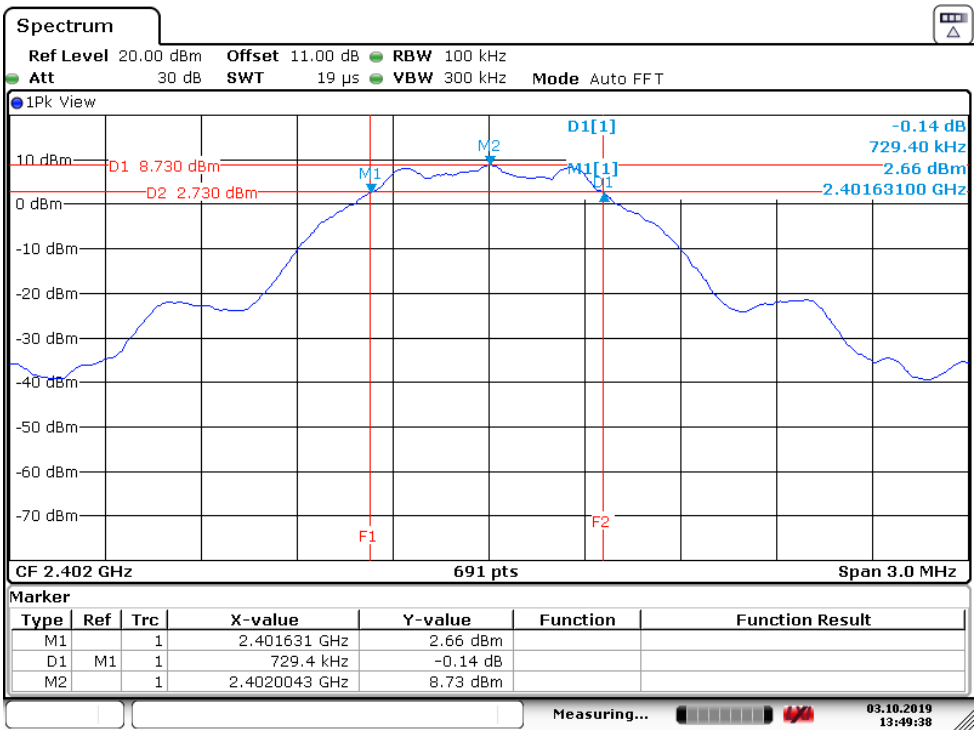
Channel	Channel Frequency (MHz)	99% Bandwidth (MHz)
Low Channel	2402	1.0507
Mid Channel	2440	1.0376
High Channel	2480	1.0469

Table 12: Test result of 99% Bandwidth, LE 2M

Channel	Channel Frequency (MHz)	99% Bandwidth (MHz)
Low Channel	2402	2.0043
Mid Channel	2440	2.0477
High Channel	2480	1.9898

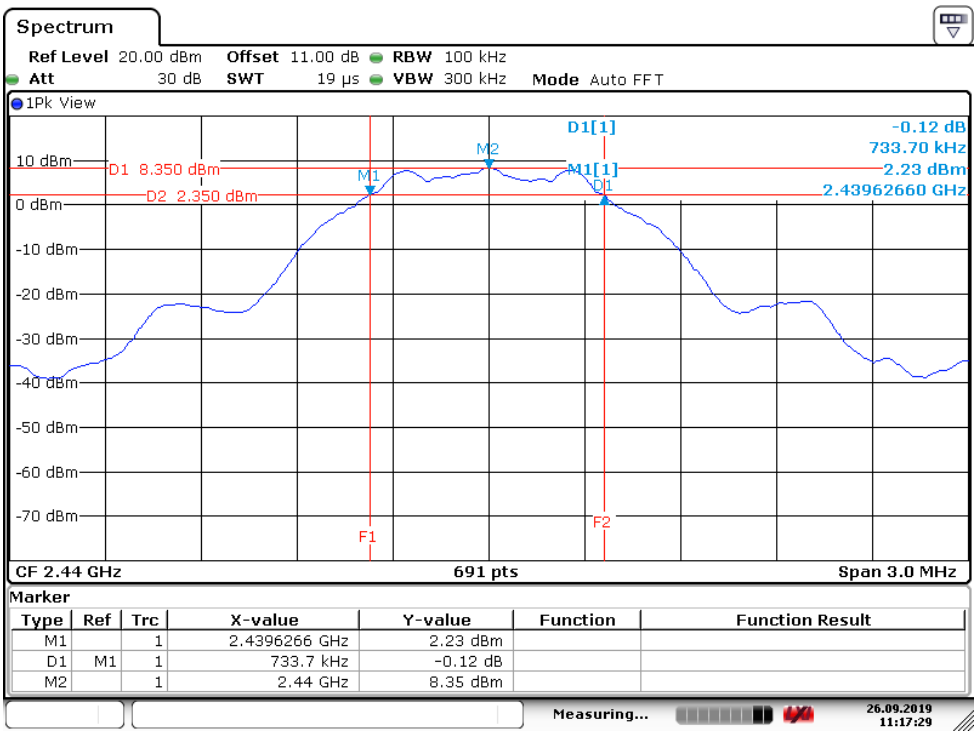
Test Plot of 6dB Bandwidth, LE 1M

Low Channel



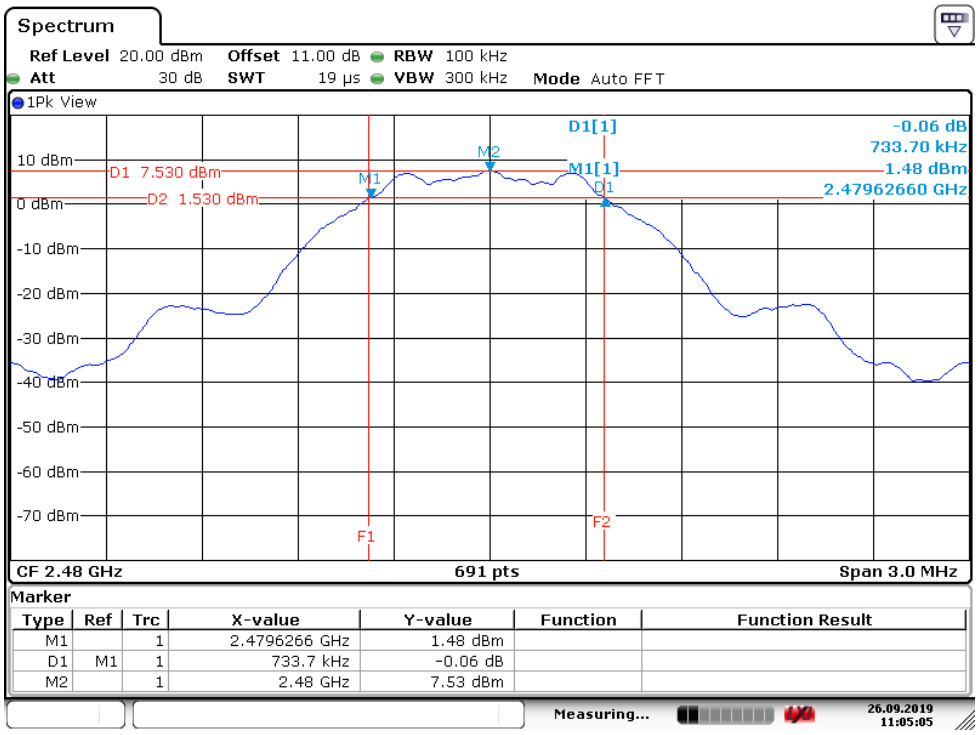
Date: 3.OCT.2019 13:49:39

Middle Channel



Date: 26.SEP.2019 11:17:30

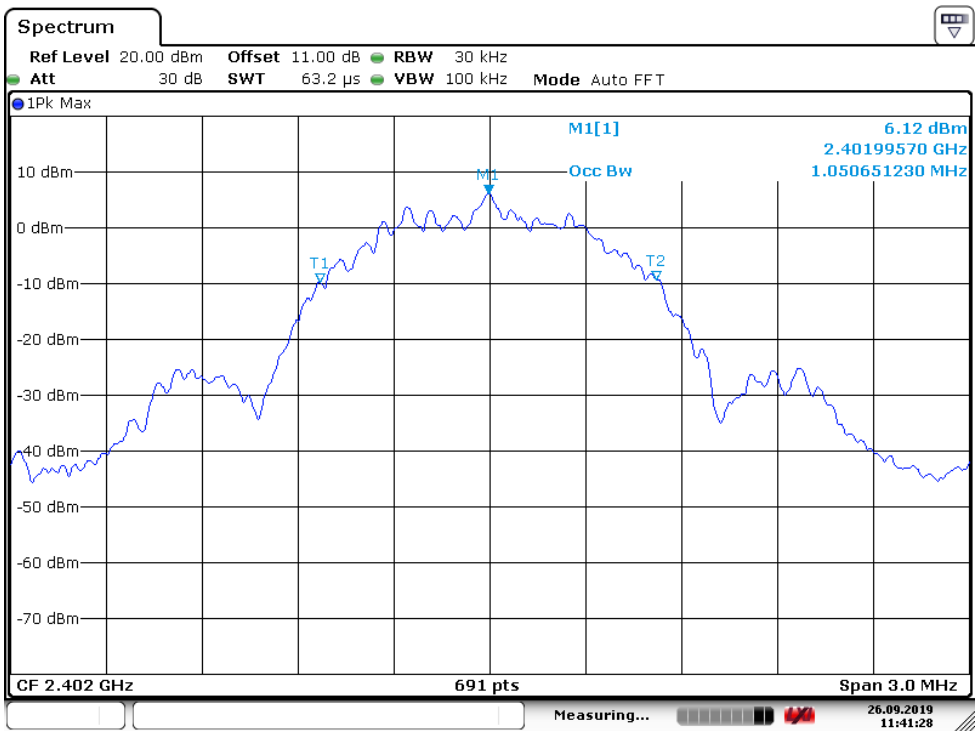
High Channel



Date: 26.SEP.2019 11:05:06

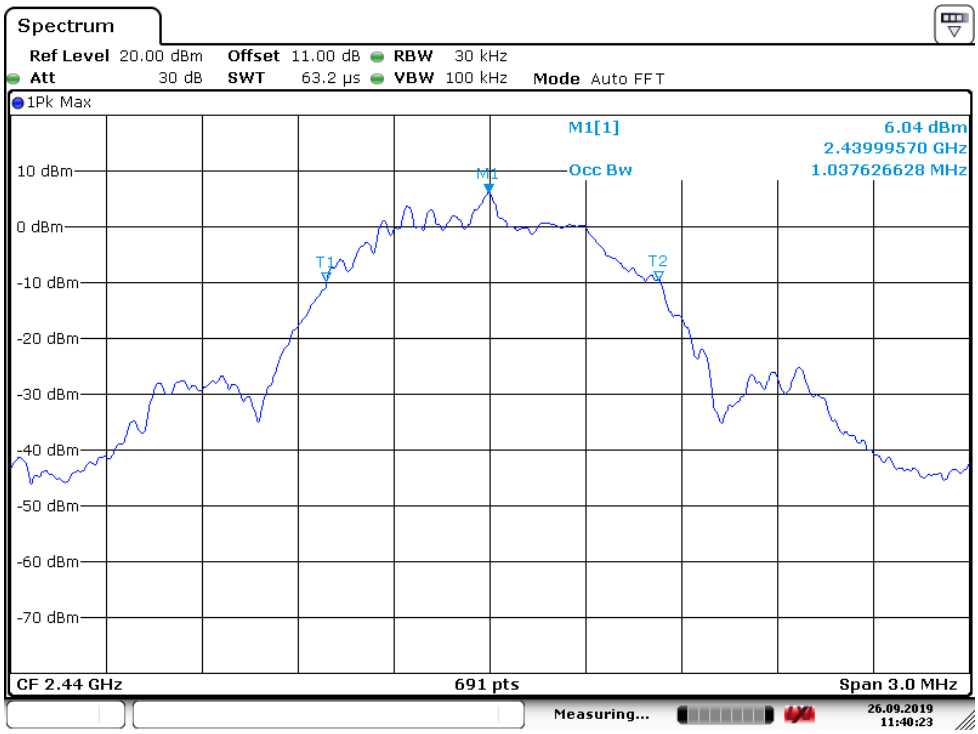
Test Plot of 99% Bandwidth, LE 1M

Low Channel



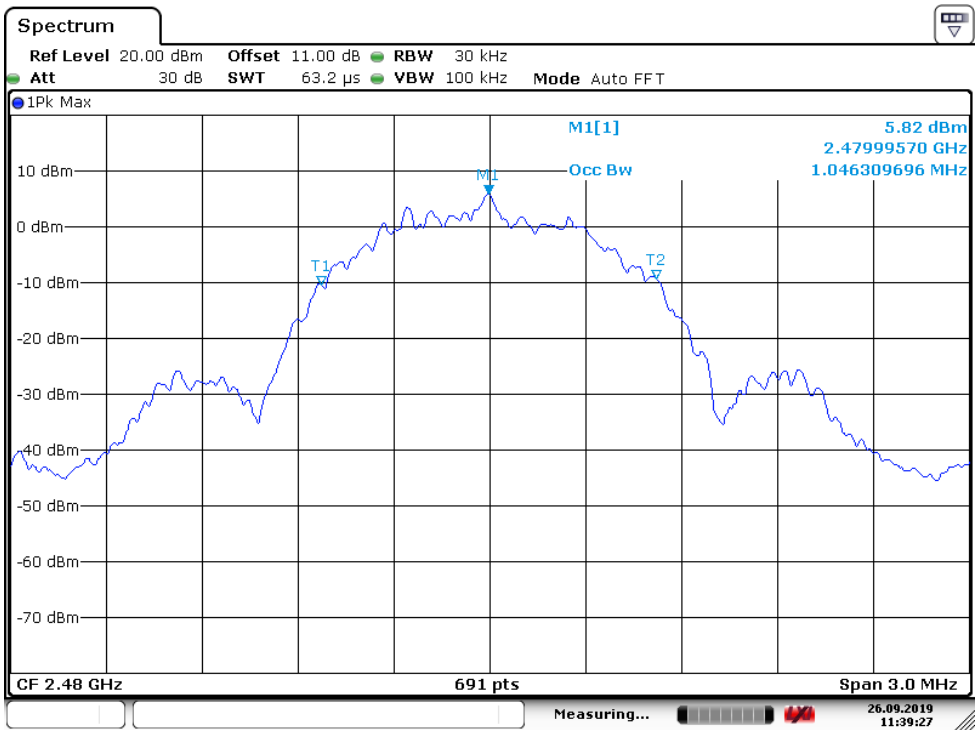
Date: 26.SEP.2019 11:41:29

Middle Channel



Date: 26.SEP.2019 11:40:24

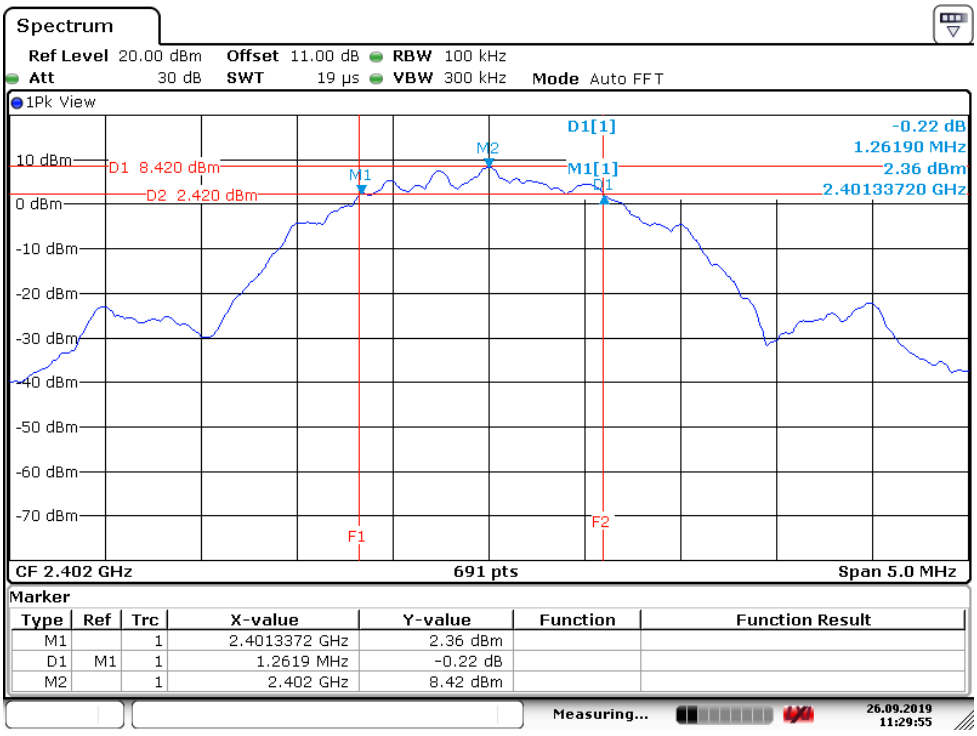
High Channel



Date: 26.SEP.2019 11:39:28

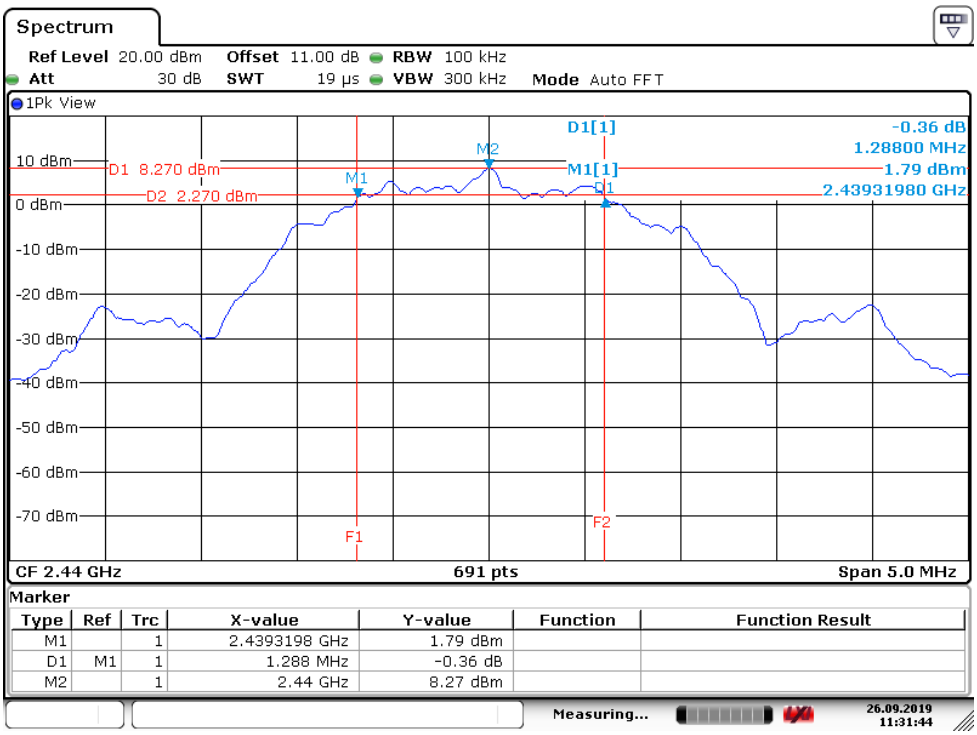
Test Plot of 6dB Bandwidth, LE 2M

Low Channel



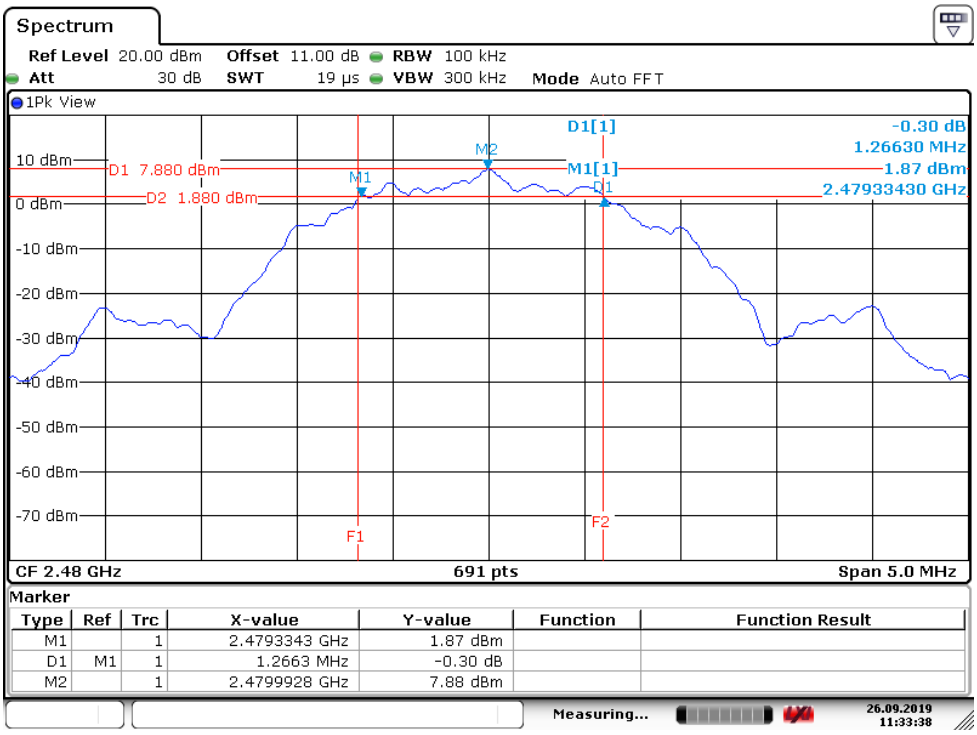
Date: 26.SEP.2019 11:29:56

Middle Channel



Date: 26.SEP.2019 11:31:45

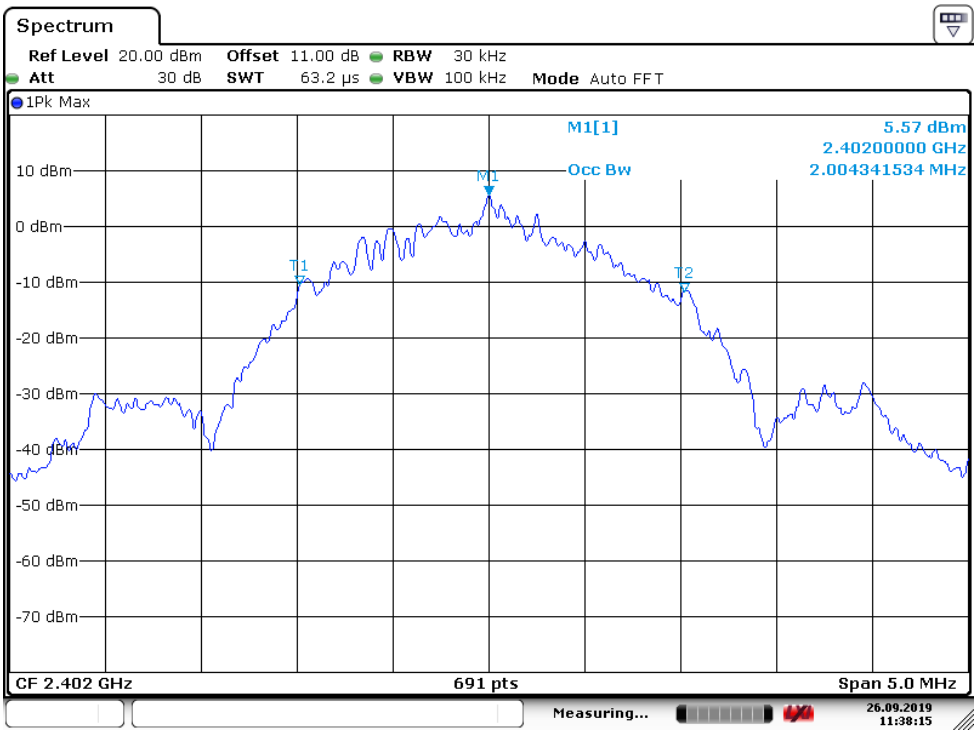
High Channel



Date: 26.SEP.2019 11:33:39

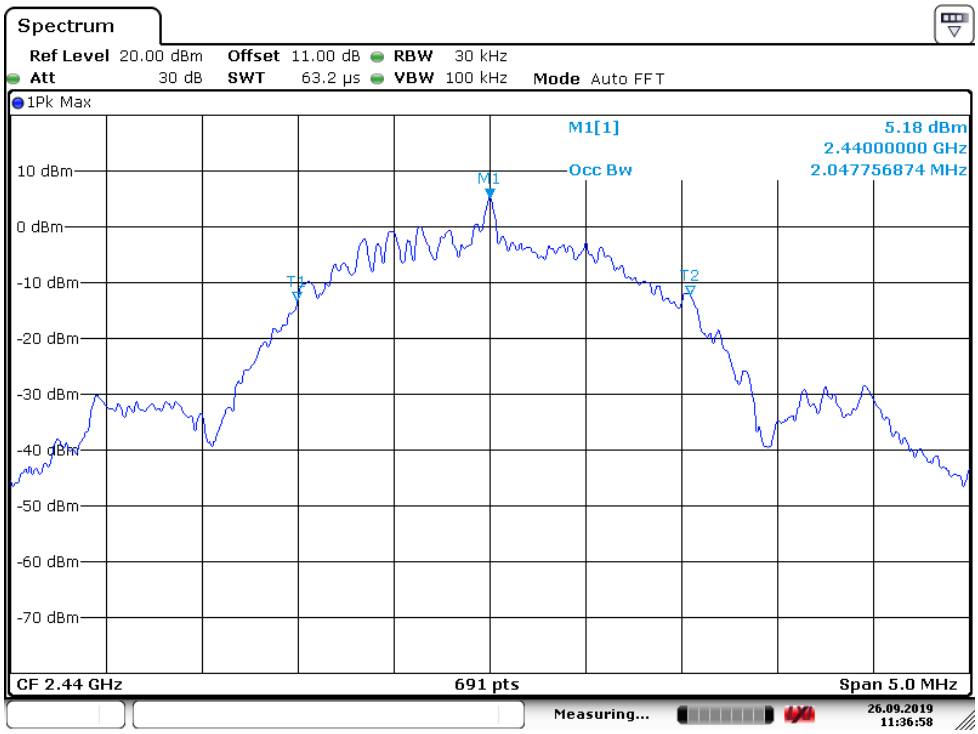
Test Plot of 99% Bandwidth, LE 2M

Low Channel



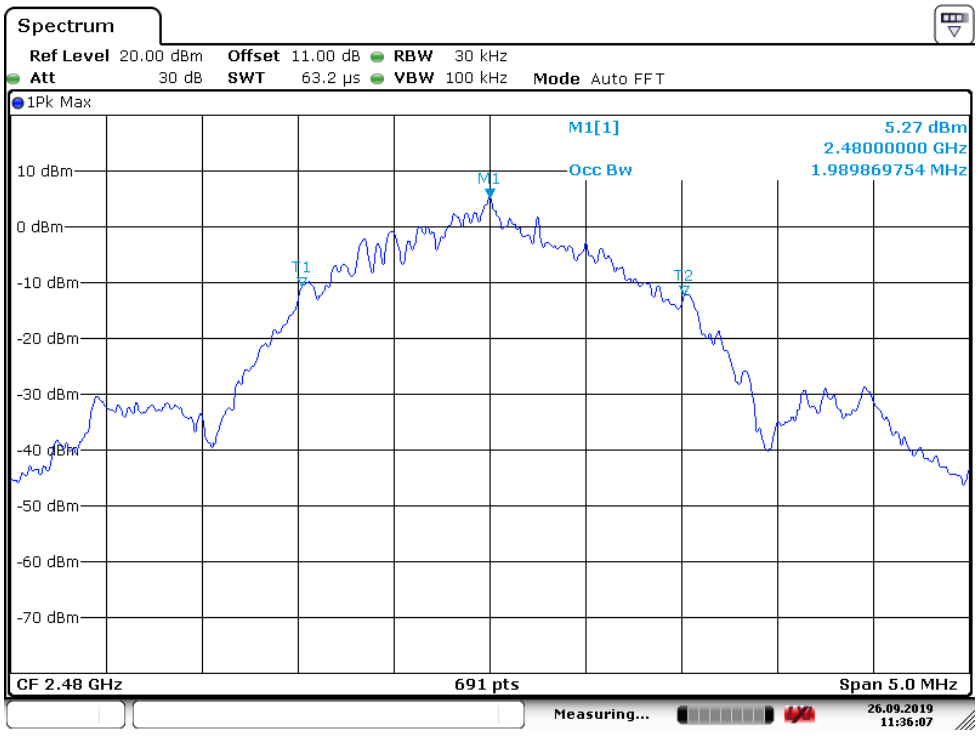
Date: 26.SEP.2019 11:38:16

Middle Channel



Date: 26.SEP.2019 11:36:58

High Channel



Date: 26.SEP.2019 11:36:07

5.1.4 Power Density

RESULT: **Passed**

Test standard : FCC Part 15.247(e) , RSS-247 5.2(b)
Basic standard : ANSI C63.10:2013, KDB558074
Kind of test site : Shielded room

Test setup

Test Channel : Low/ Middle/ High
Operation Mode : A
Ambient temperature : 20-24°C
Relative humidity : 50-65%
Atmospheric pressure : 100-103 kPa

Table 13: Test result of Power Density, LE 1M

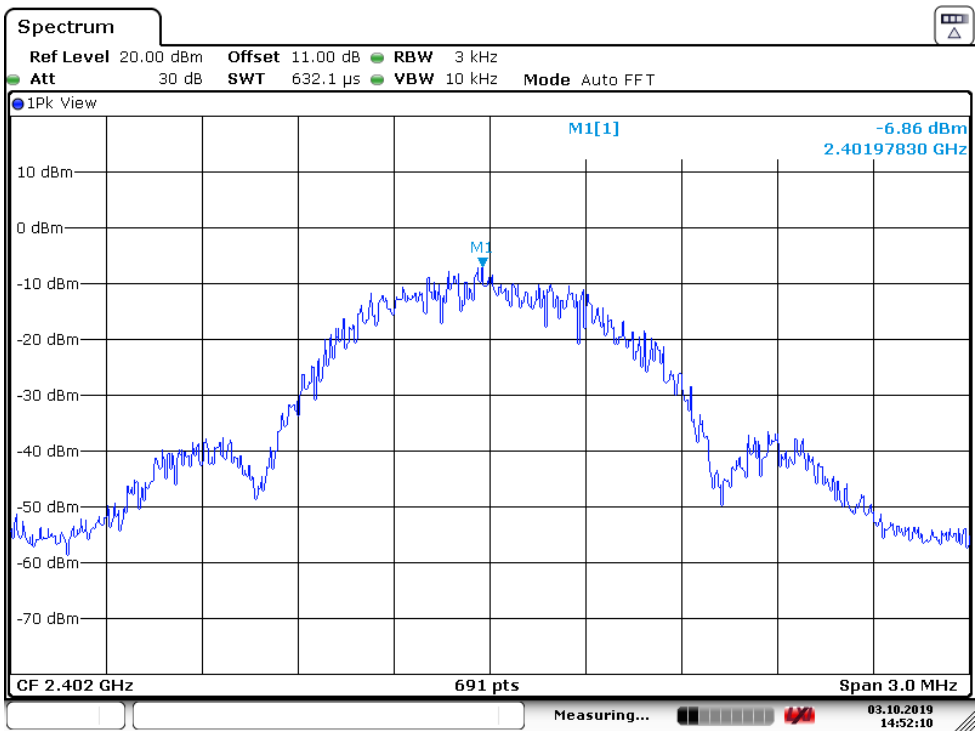
Channel	Channel Frequency (MHz)	Power Density	Limit
		(dBm)	(dBm)
Low Channel	2402	-6.86	8
Middle Channel	2440	-6.84	8
High Channel	2480	-6.94	8

Table 14: Test result of Power Density, LE 2M

Channel	Channel Frequency (MHz)	Power Density	Limit
		(dBm)	(dBm)
Low Channel	2402	-9.52	8
Middle Channel	2440	-9.59	8
High Channel	2480	-9.77	8

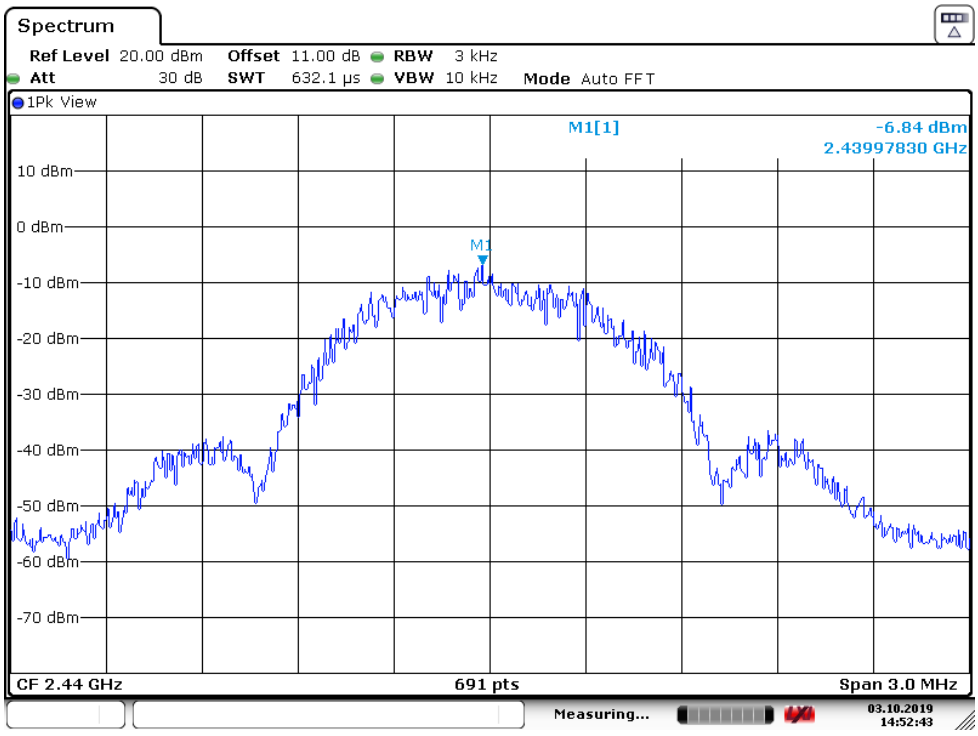
Test Plot of Power Density, LE 1M

Low Channel



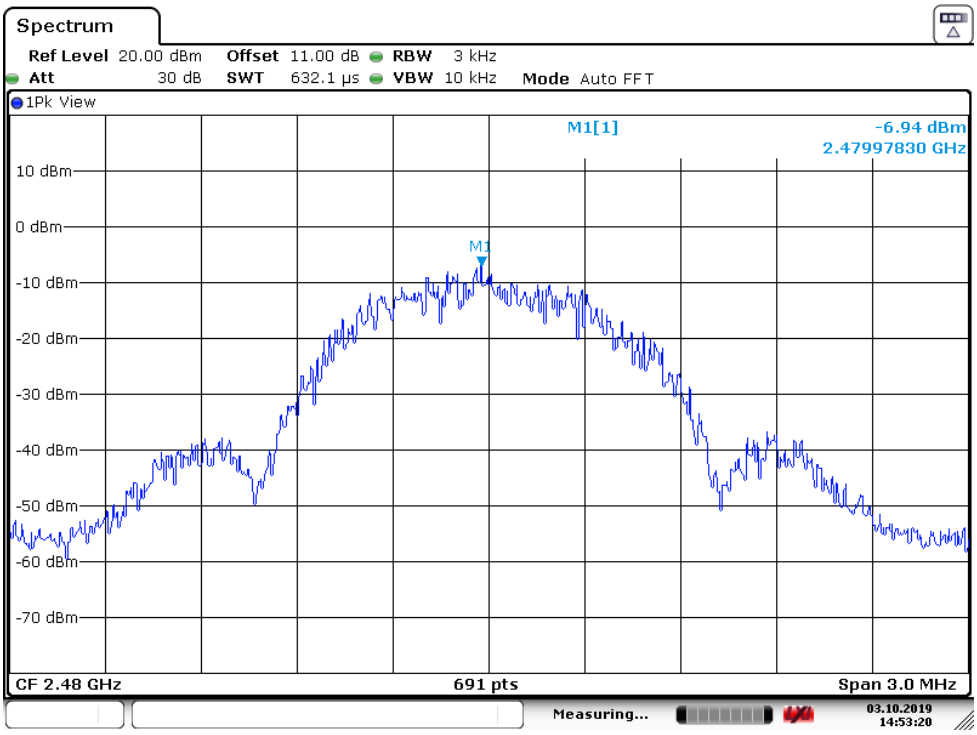
Date: 3.OCT.2019 14:52:10

Middle Channel



Date: 3.OCT.2019 14:52:43

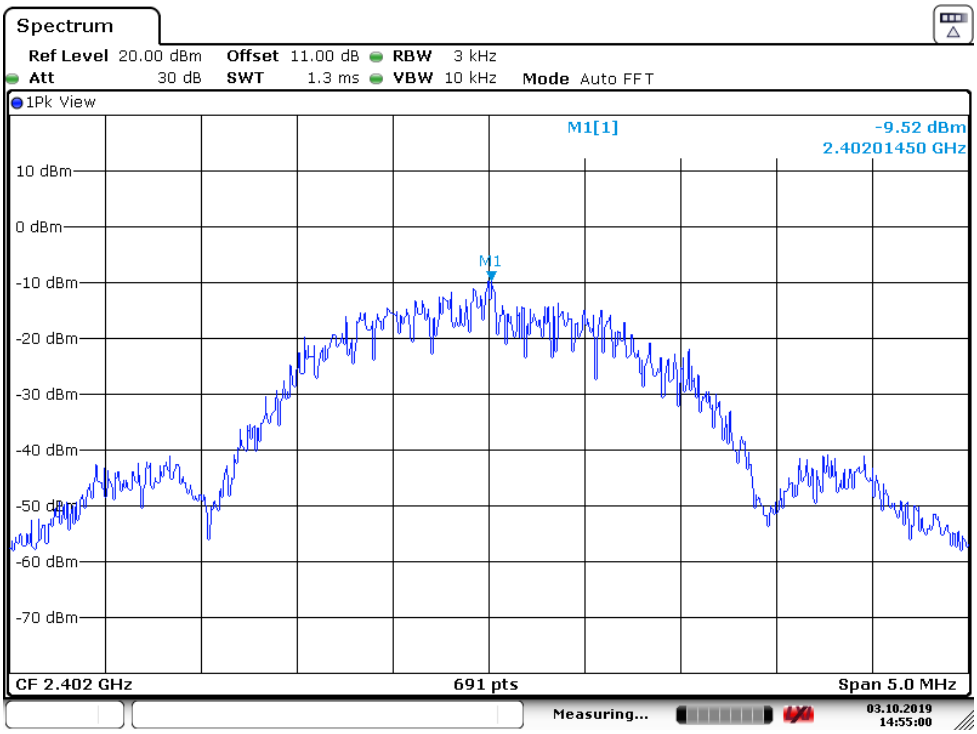
High Channel



Date: 3.OCT.2019 14:53:20

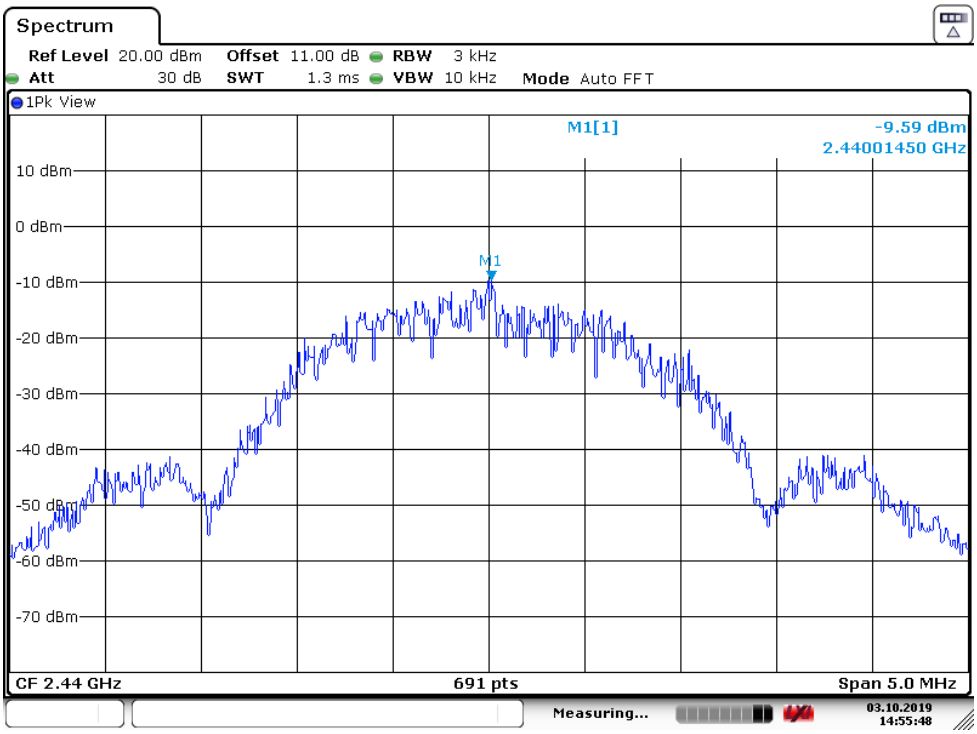
Test Plot of Power Density, LE 2M

Low Channel



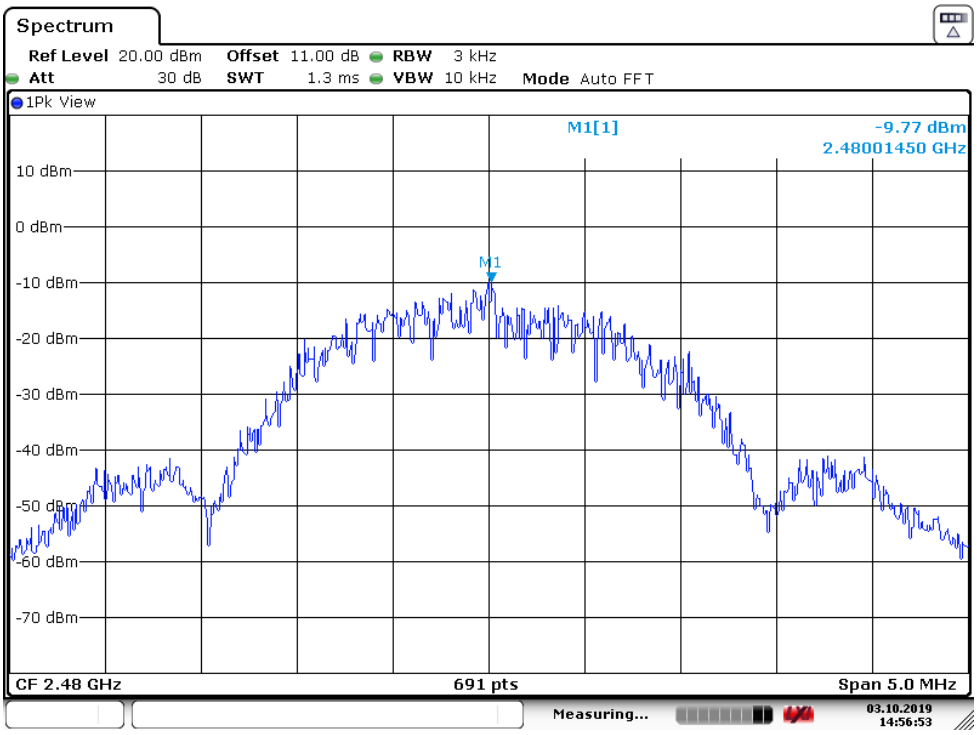
Date: 3.OCT.2019 14:55:01

Middle Channel



Date: 3.OCT.2019 14:55:48

High Channel



Date: 3.OCT.2019 14:56:54

5.1.5 Conducted spurious emissions and Frequency Band Edge measured in 100kHz Bandwidth

RESULT: **Passed**

Test standard	:	FCC part 15.247(d), RSS-247 5.5
Basic standard	:	ANSI C63.10:2013, KDB558074
Limit	:	20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power)
Kind of test site	:	Shielded room

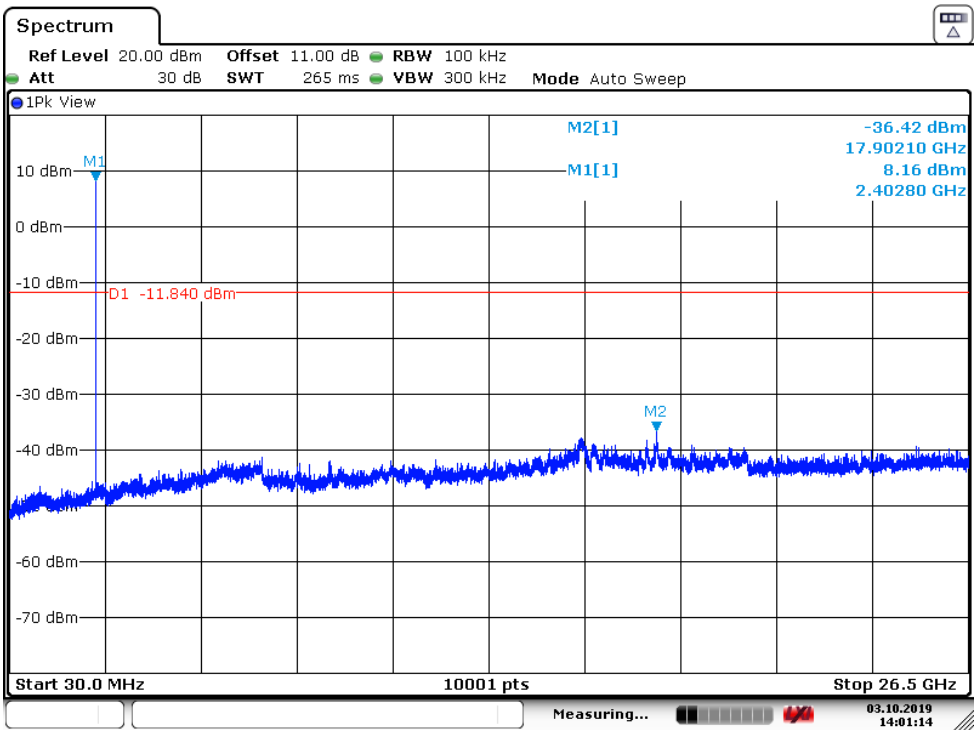
Test setup

Test Channel	:	Low/ Mid/ High for spurious, Low/ High for Band Edge
Operation mode	:	A
Ambient temperature	:	20-24°C
Relative humidity	:	50-65%
Atmospheric pressure	:	100-103 kPa

All emissions are more than 20dB below fundamental, details refer to following test plot, and compliance is achieved as well.
Due to the small size of the product and that there are no inductive components of significant size, 9kHz to 30MHz frequency range is not tested based on technical judgment.

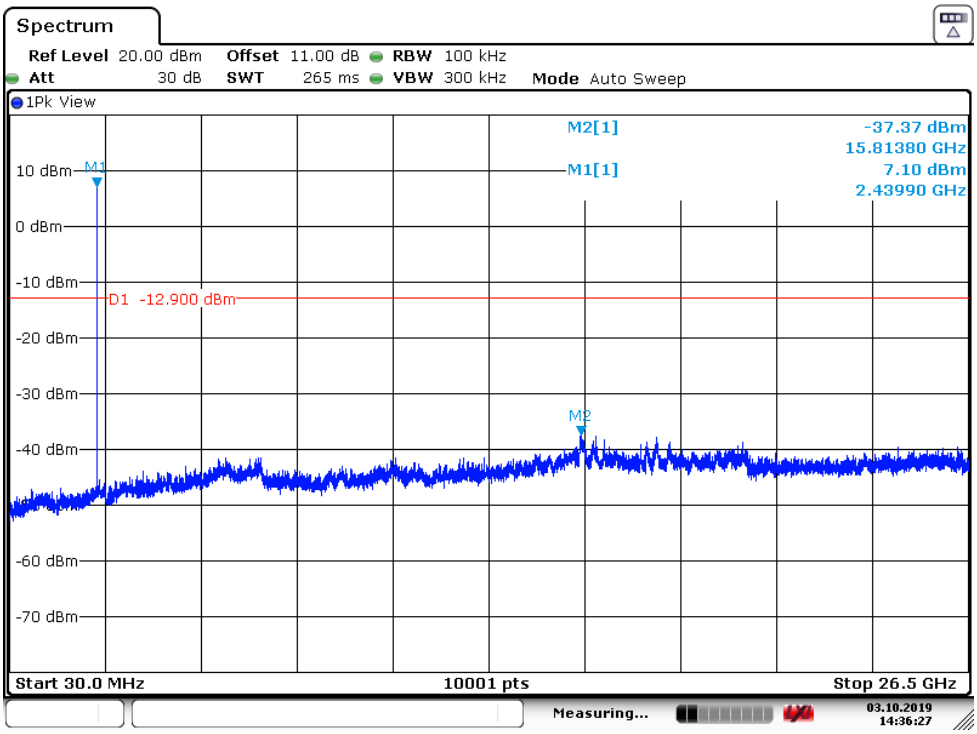
Test Plot 100kHz Conducted Emissions, LE 1M

Low Channel



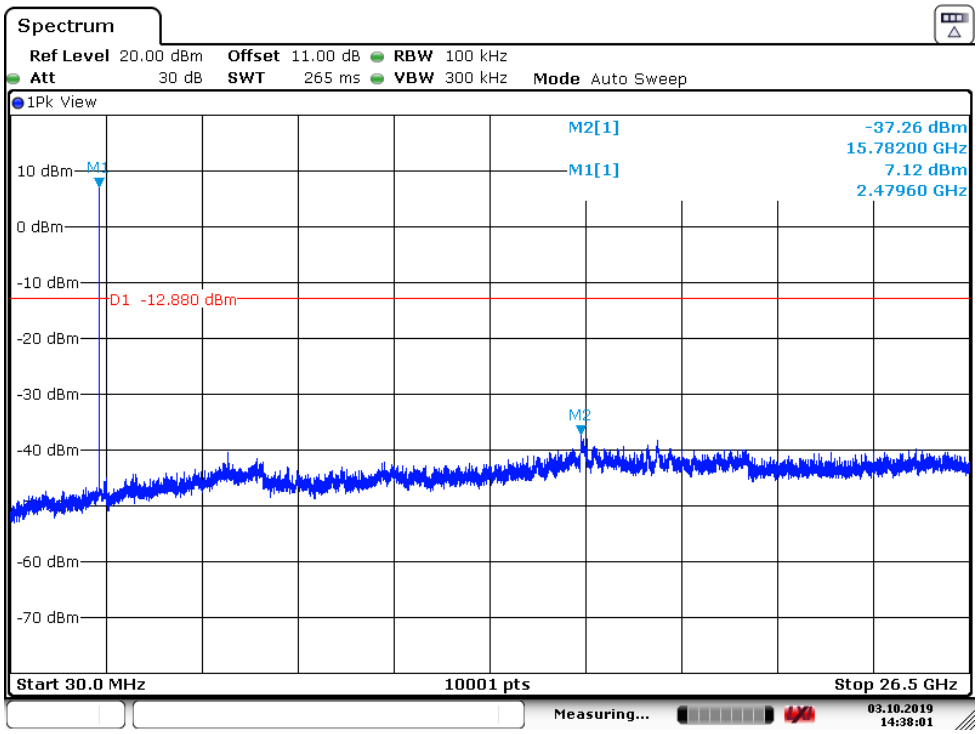
Date: 3.OCT.2019 14:01:14

Middle Channel



Date: 3.OCT.2019 14:36:28

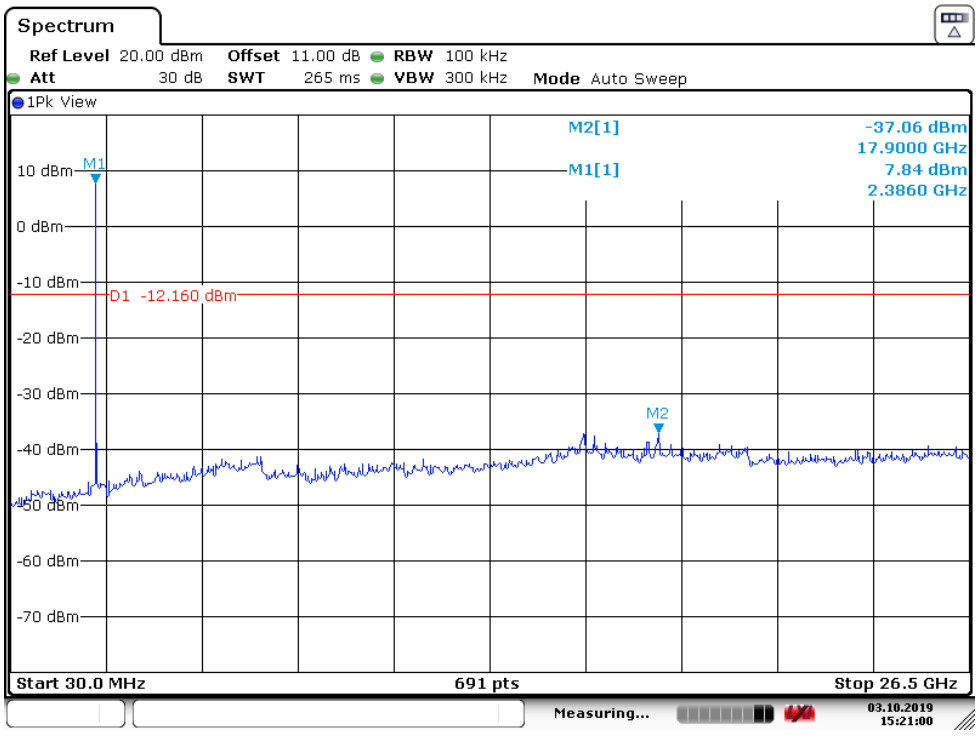
High Channel



Date: 3.OCT.2019 14:38:01

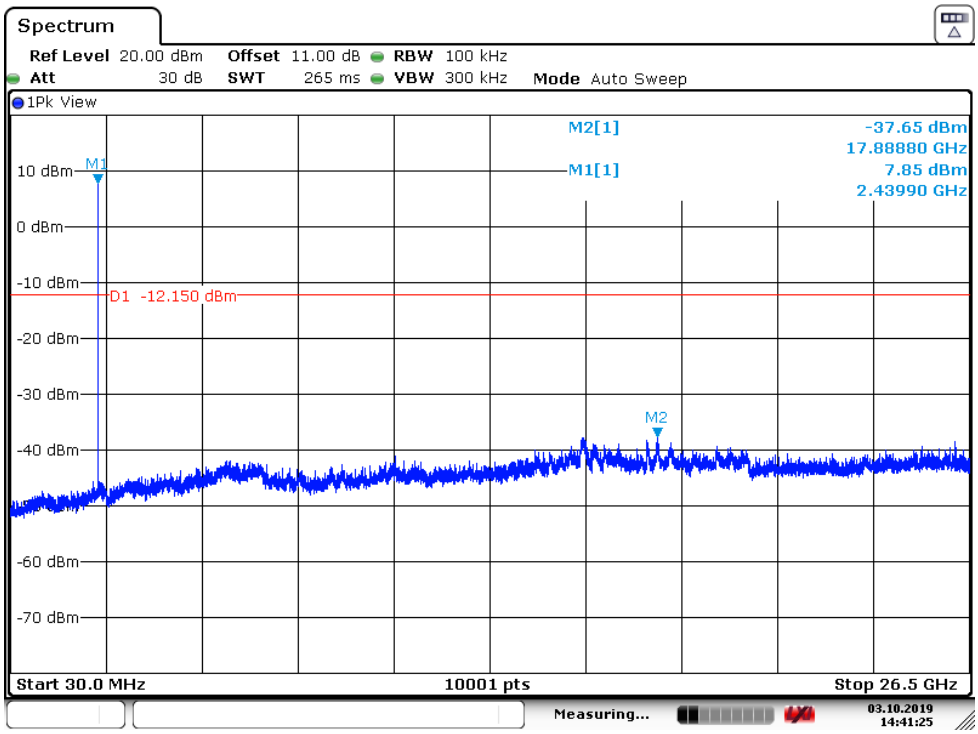
Test Plot 100kHz Conducted Emissions, LE 2M

Low Channel



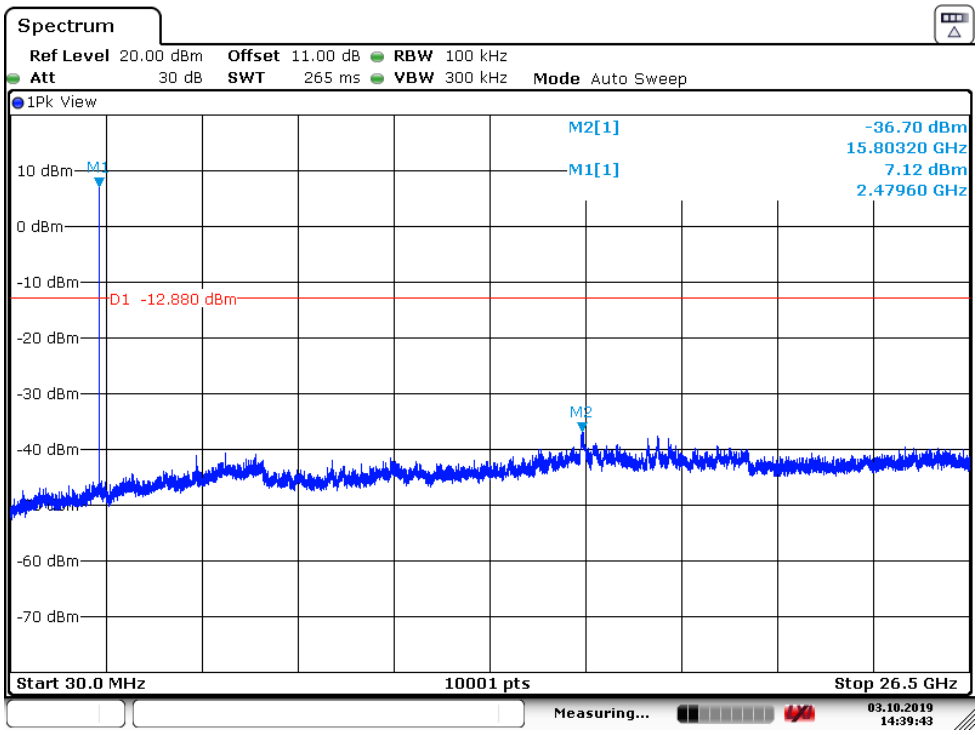
Date: 3.OCT.2019 15:21:01

Middle Channel



Date: 3.OCT.2019 14:41:26

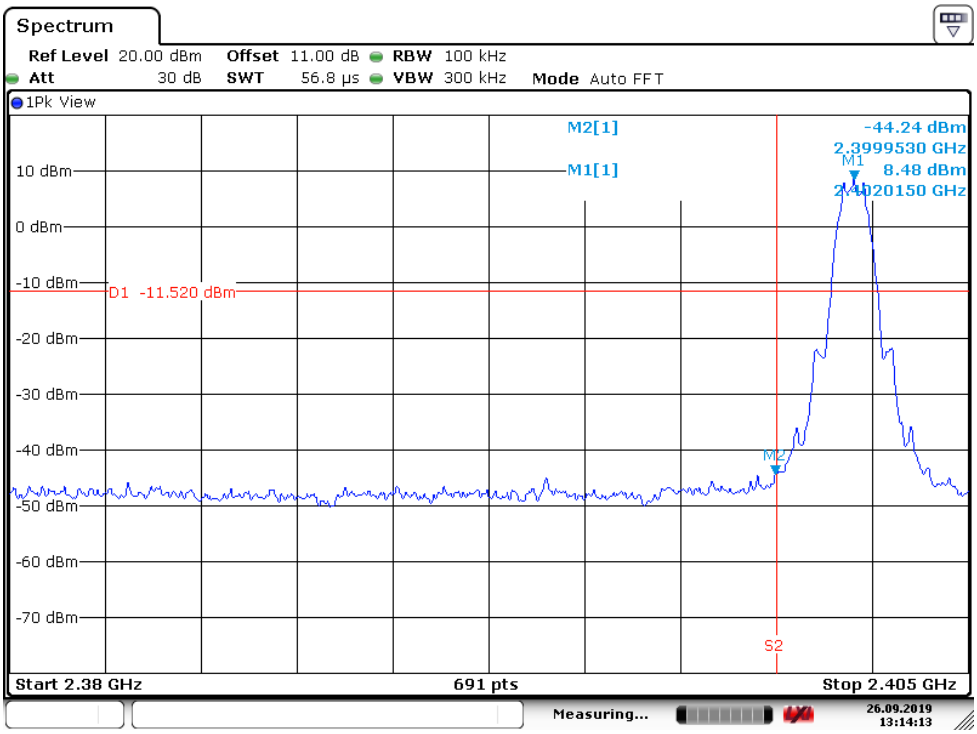
High Channel



Date: 3.OCT.2019 14:39:44

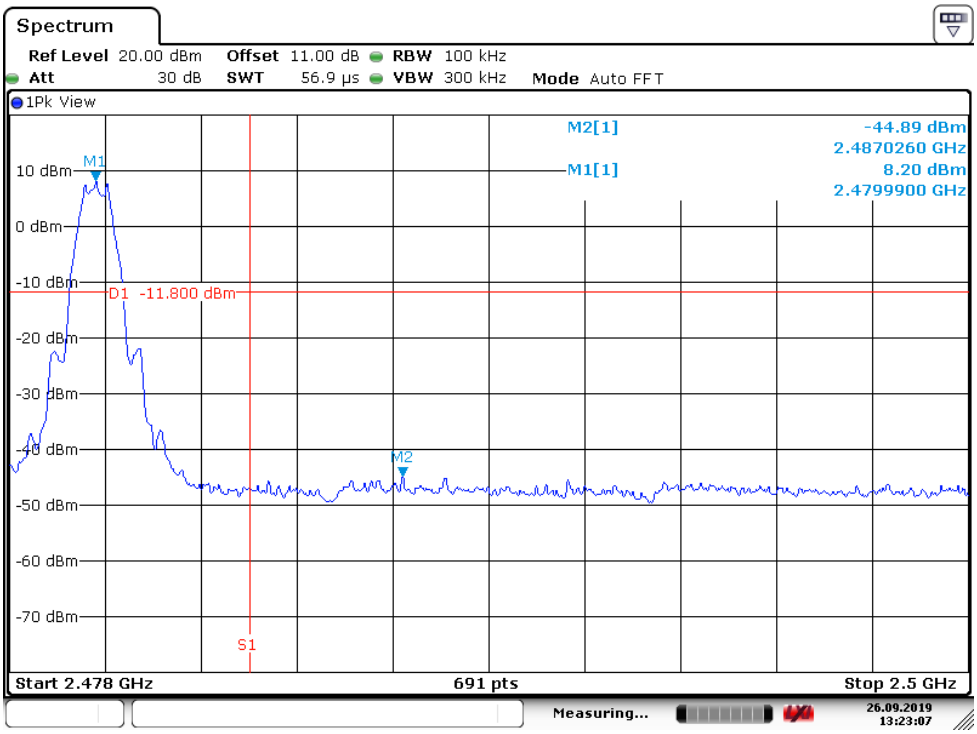
Test Plot 100kHz RBW Band Edge, LE 1M

Low Channel



Date: 26.SEP.2019 13:14:13

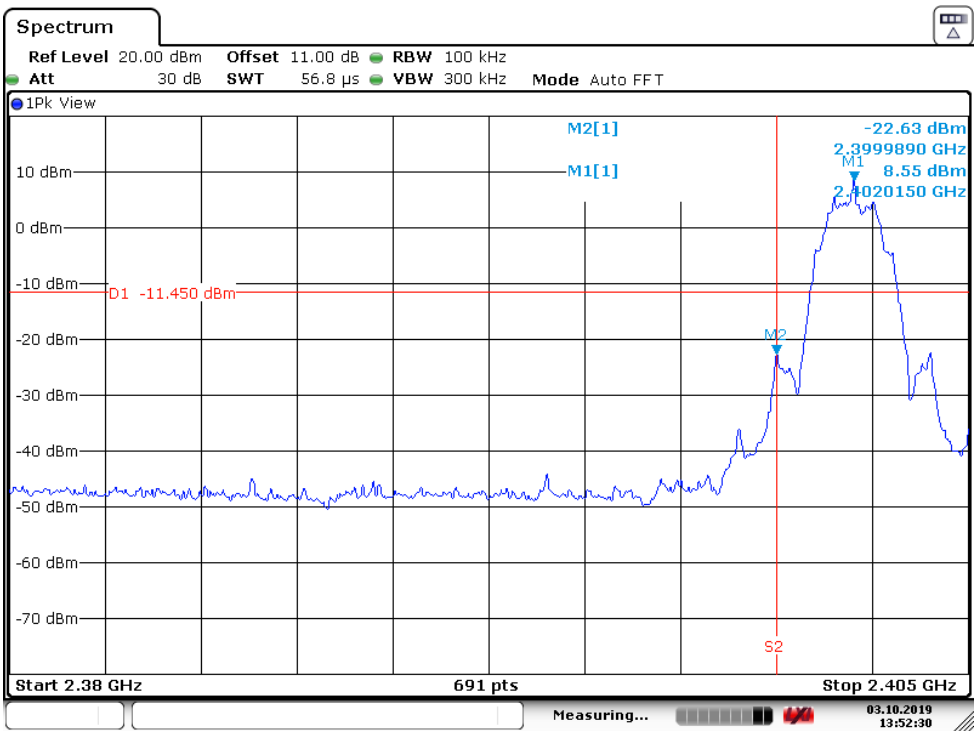
High Channel



Date: 26.SEP.2019 13:23:07

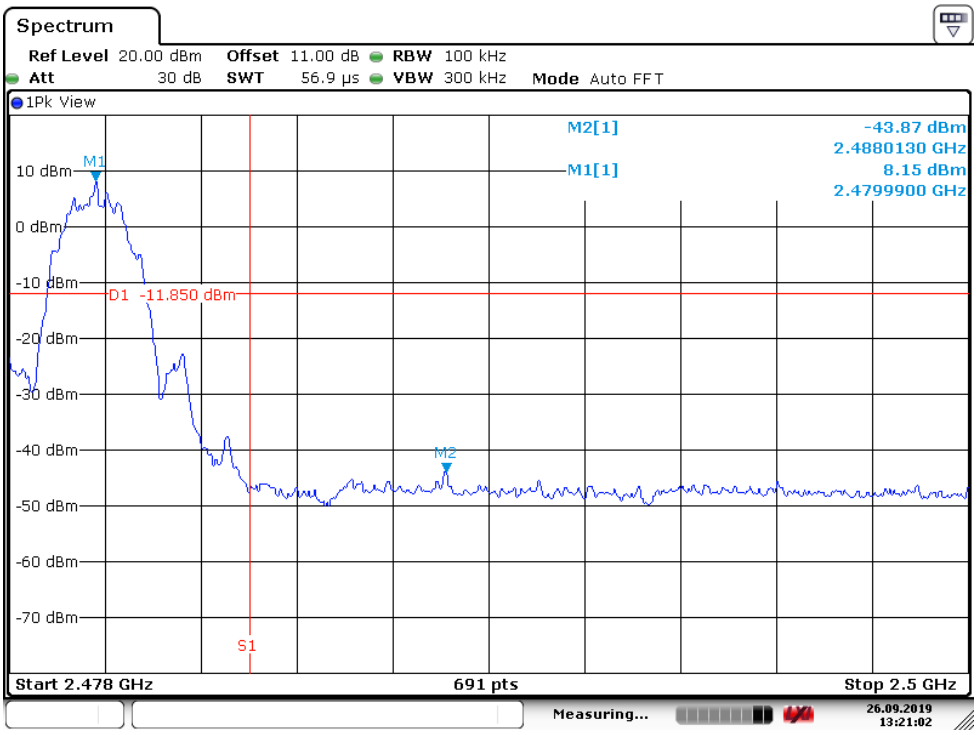
Test Plot 100kHz RBW of Band Edge, LE 2M

Low Channel



Date: 3.OCT.2019 13:52:30

High Channel



Date: 26.SEP.2019 13:21:02

5.1.6 Spurious Emission

RESULT: **Passed**

Test standard	:	FCC part 15.247(d), FCC 15.205, FCC 15.209, RSS-247 5.5 and RSS-Gen issue 5 LP0002(2018): 3.10.1, (5)
Basic standard	:	ANSI C63.10: 2013
Limits	:	Radiated emissions which fall in the restricted bands, as defined in FCC 15.205(a) and RSS-Gen i5, 8.10 (Table 7), must comply with the radiated emission limits specified in FCC 15.209(a) and RSS-Gen i5, 8.9 (Table 5 and 6). Emission radiated outside the specified frequency bands must comply with the radiated emission limits specified in FCC 15.209(a) and RSS-Gen i5, 8.9 (Table 5 and 6).
Kind of test site	:	3m Semi-Anechoic Chamber

Test setup

Test Channel	:	Low/ Middle/ High
Operation mode	:	A, B

For details refer to Appendix D.

The Radiated Emissions testing was performed in the X, Y and Z axis orientation. The worst-case Axis orientation is recorded in this test report.

Factor (dB/m)=Antenna Factor(dB/m)+Cable loss (dB)
Level(dBuV/m)=Reading(dBuV)+ Factor(dB/m)

6. Safety Human exposure

6.1 Radio Frequency Exposure Compliance

6.1.1 Electromagnetic Fields

RESULT: **Passed**

Test standard	:	FCC KDB Publication 447498 D01 v06 47CFR 1.1310 47CFR 2.1091 RSS-102 issue 5

The maximum of Average output power is 7.14dBm(5.17mW)

FCC:
Therefore the maximum output power of the transmitter is 5.17mW < 10mW(Distance: 5 mm), hence the EUT is excluded from SAR evaluation according to FCC KDB publication 447498 D01: Mobile Portable RF Exposure.

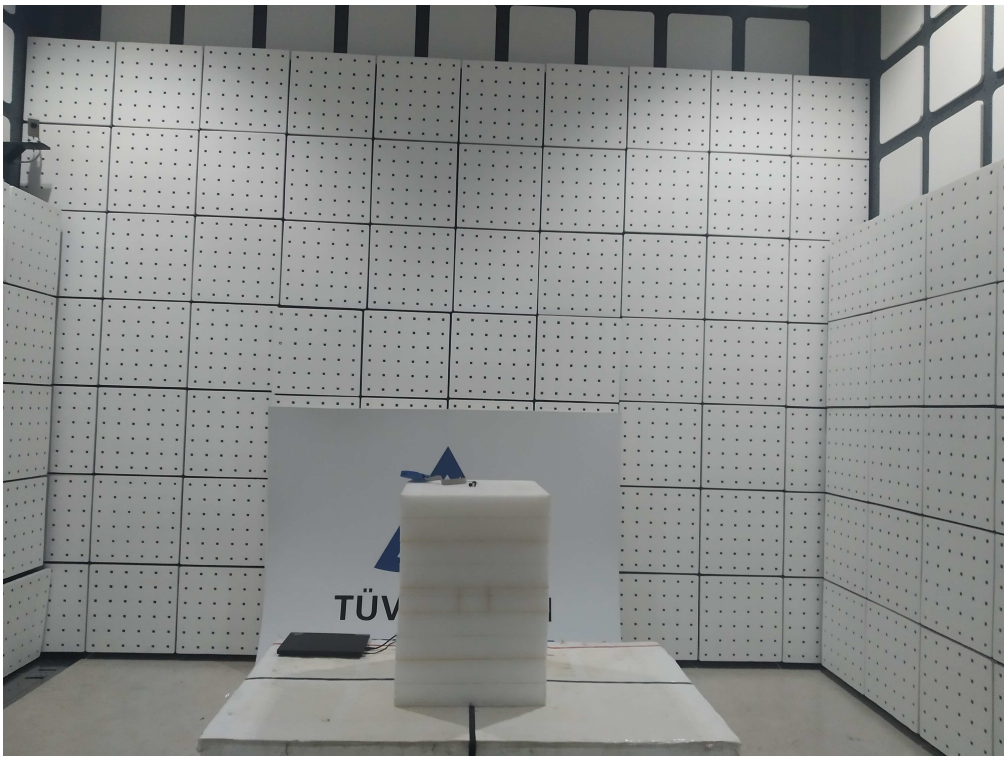
Canada:
Please refer to the SAR test report BTL-ISED SAR-1-1910T078 R00.

---End---

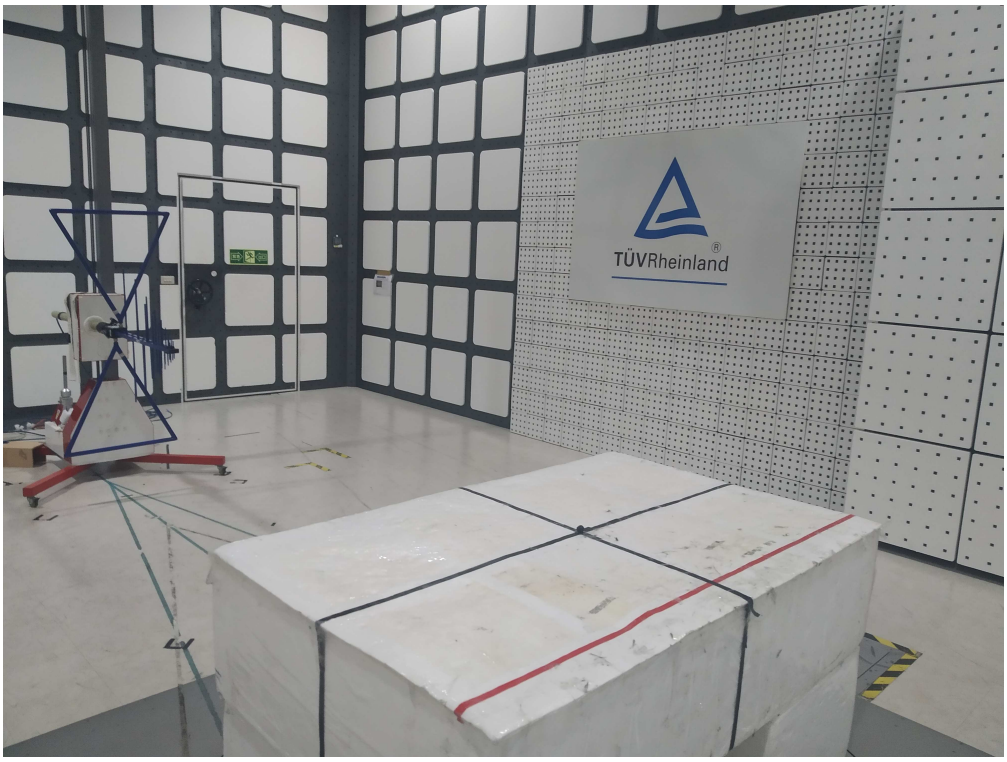
7. Photographs of the Test Set-Up

Photograph 1: Set-up for Spurious Emissions (Front View 1)

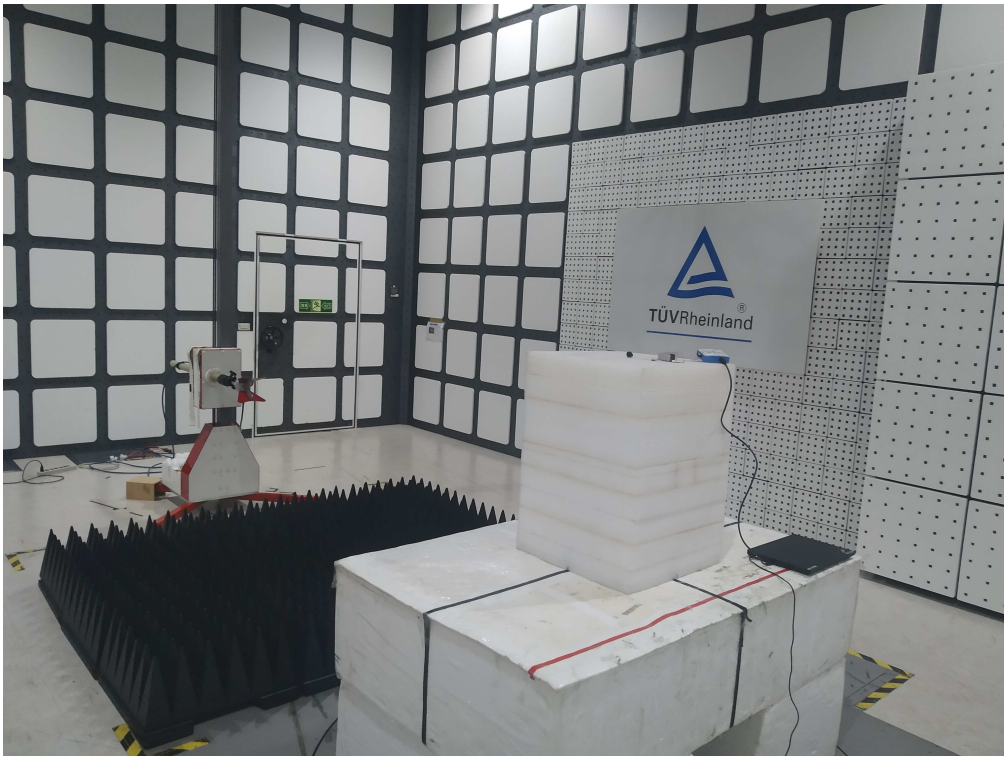
Photograph 2: Set-up for Spurious Emissions (Front View 2)



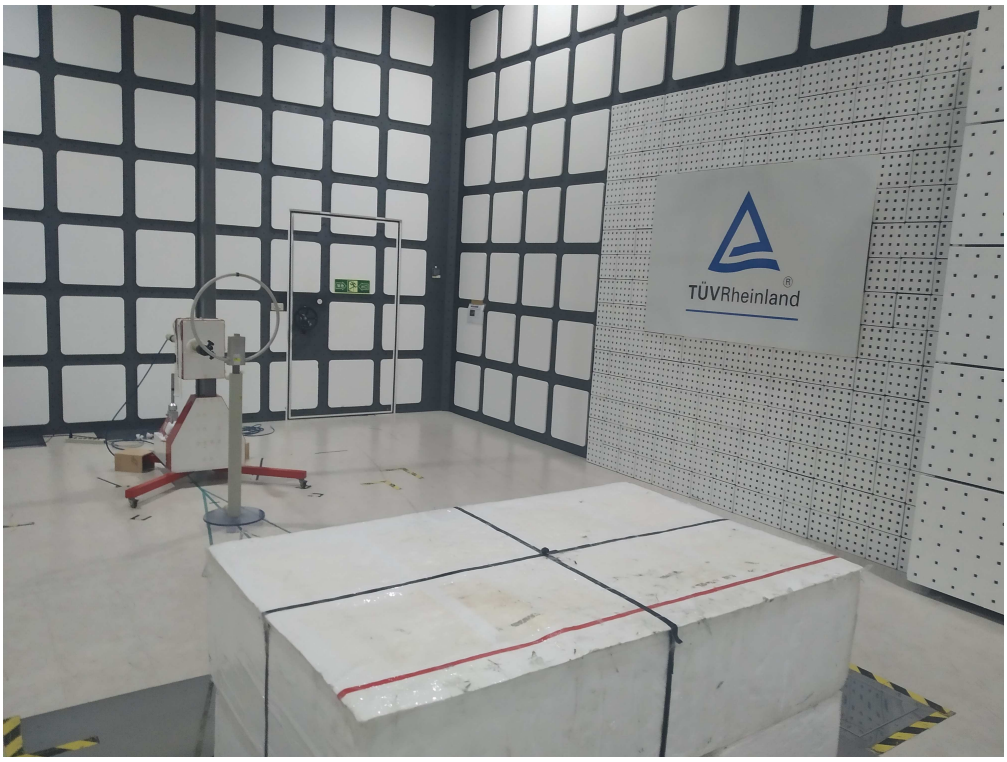
Photograph 3: Set-up for Spurious Emissions (Back View 1)



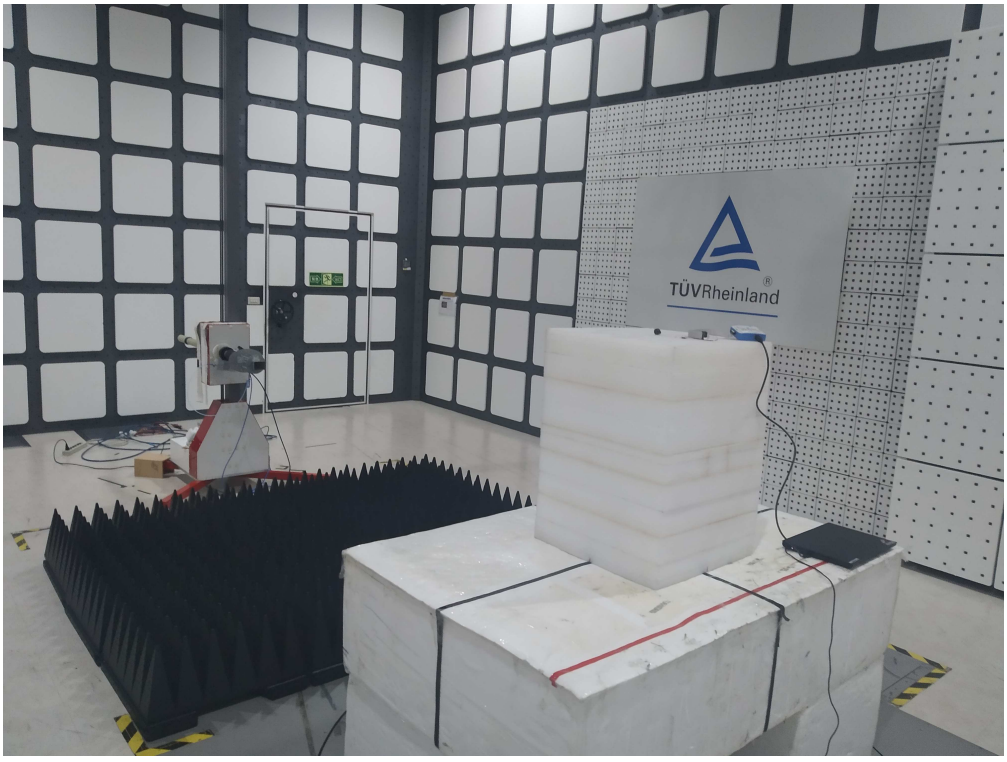
Photograph 4: Set-up for Spurious Emissions (Back View 2)



Photograph 5: Set-up for Spurious Emissions (Back View 3)

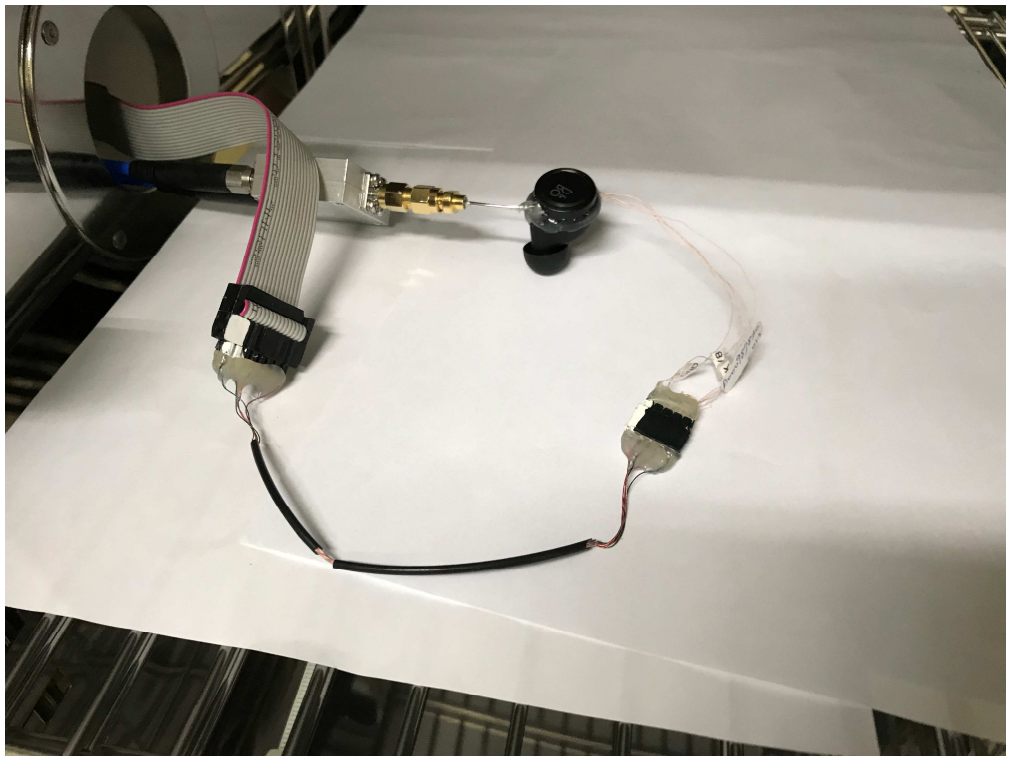


Photograph 6: Set-up for Spurious Emissions (Back View 4)



Photograph 7: Set-up for Conducted testing

Photograph 8: Set-up for Conducted testing



8. List of Tables

9. List of Photographs