CFR 47 FCC PART 15 SUBPART C
ISED RSS-247 ISSUE 2

CERTIFICATION TEST REPORT

For

Sound Tower

FCC MODEL NUMBER: MX-ST4, MX-ST4***** (“*” represents any alphanumeric character, “-”, “/” or Blank)**

ISED MODEL NUMBER: MX-ST40B, MX-ST4CB

FCC ID: A3LMXST40B

IC: 649E-MXST40B

REPORT NUMBER: 44790251352-3

ISSUE DATE: February 8, 2022

Prepared for

Samsung Electronics Co Ltd (FCC)
19 Chapin Rd., Building D Pine Brook New Jersey United States 07058

SAMSUNG ELECTRONICS CO. LTD. (ISED)
129 Samsung-ro, Yeongtong-gu Suwon-Si Gyeonggi-do 16677 Korea (Republic Of)

Prepared by

UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch

Building 10, Innovation Technology Park, No. 1, Li Bin Road, Song Shan Lake Hi-Tech Development Zone Dongguan, 523808, People’s Republic of China

Tel: +86 769 22038881
Fax: +86 769 33244054
Website: www.ul.com

Revision History

Rev.	Issue Date	Revisions	Revised By
V0	02/08/2022	Initial Issue	

Summary of Test Results			
Clause	**Test Items**	**FCC/ISED Rules**	**Test Results**
1	6dB Bandwidth and 99% Occupied Bandwidth	FCC Part 15.247 (a) (2) RSS-247 Clause 5.2 (a) ISED RSS-Gen Clause 6.7	Pass
2	Peak Conducted Output Power	FCC Part 15.247 (b) (3) RSS-247 Clause 5.4 (d)	Pass
3	Power Spectral Density	FCC Part 15.247 (e) RSS-247 Clause 5.2 (b)	Pass
4	Conducted Bandedge and Spurious Emission	FCC Part 15.247 (d) RSS-247 Clause 5.5	Pass
5	Radiated Bandedge and Spurious Emission	FCC Part 15.247 (d) FCC Part 15.209 FCC Part 15.205 RSS-247 Clause 5.5 RSS-GEN Clause 8.9	Pass
6	Conducted Emission Test for AC Power Port	FCC Part 15.207 RSS-GEN Clause 8.8	Pass
7	Antenna Requirement	FCC Part 15.203 RSS-GEN Clause 6.8	Pass
Note: 1.This test report is only published to and used by the applicant, and it is not for evidence purpose in China. 2. The measurement result for the sample received is <Pass> according to < CFR 47 FCC PART 15 SUBPART C >< ISED RSS-247 > when <Accuracy Method> decision rule is applied.			

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

FCC
Applicant Information

Company Name:	Samsung Electronics Co Ltd
Address:	19 Chapin Rd., Building D Pine Brook New Jersey United States 07058

ISED
Applicant Information

Company Name:	SAMSUNG ELECTRONICS CO. LTD.
Address:	129 Samsung-ro, Yeongtong-gu Suwon-Si Gyeonggi-do 16677 Korea (Republic Of)

FCC
Manufacturer Information

Company Name:	Samsung Electronics Co Ltd
Address:	19 Chapin Rd., Building D Pine Brook New Jersey United States 07058

ISED
Manufacturer Information

Company Name:	SAMSUNG ELECTRONICS CO. LTD.
Address:	129 Samsung-ro, Yeongtong-gu Suwon-Si Gyeonggi-do 16677 Korea (Republic Of)

EUT Information

EUT Name:	Sound Tower
FCC Model:	MX-ST4**, MX-ST4***** (“*” represents any alphanumeric character, “-”, “/” or Blank)
ISED Model:	MX-ST40B, MX-ST4CB
Model difference:	Please refer to clause 5.1. Description of EUT
Brand:	SAMSUNG
Sample Received Date:	January 18, 2022
Sample Status:	Normal
Sample ID:	4553132
Date of Tested:	January 18, 2022~ January 27, 2022

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 FCC PART 15 SUBPART C	PASS
ISED RSS-247 Issue 2	PASS
ISED RSS-GEN Issue 5	PASS

Prepared By:

Kebo Zhang
Project Engineer

Checked By:

Shawn Wen
Laboratory Leader

Approved By:

Stephen Guo
Laboratory Manager

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with KDB 558074 D01 15.247 Meas Guidance v05r02, 414788 D01 Radiated Test Site v01r01, CFR 47 FCC Part 2, CFR 47 FCC Part 15, ANSI C63.10-2013, ISED RSS-247 Issue 2 and ISED RSS-GEN Issue 5.

3. FACILITIES AND ACCREDITATION

Accreditation Certificate	**A2LA (Certificate No.: 4102.01)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with A2LA. **FCC (FCC Designation No.: CN1187)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. Has been recognized to perform compliance testing on equipment subject to the Commission's Delcaration of Conformity (DoC) and Certification rules **ISED (Company No.: 21320)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been registered and fully described in a report filed with ISED. The Company Number is 21320 and the test lab Conformity Assessment Body Identifier (CABID) is CN0046. **VCCI (Registration No.: G-20019, R-20004, C-20012 and T-20011)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with VCCI, the Membership No. is 3793. Facility Name: Chamber D, the VCCI registration No. is G-20019 and R-20004 Shielding Room B , the VCCI registration No. is C-20012 and T-20011

Note 1: All tests measurement facilities use to collect the measurement data are located at Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China

Note 2: The test anechoic chamber in UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch had been calibrated and compared to the open field sites and the test anechoic chamber is shown to be equivalent to or worst case from the open field site.

Note 3: For below 30 MHz, lab had performed measurements at test anechoic chamber and comparing to measurements obtained on an open field site. And these measurements below 30 MHz had been correlated to measurements performed on an OFS.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations and is traceable to recognize national standards.

4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test Item	Uncertainty
Conduction emission	3.62 dB
Radiated Emission (Included Fundamental Emission) (9 kHz ~ 30 MHz)	2.2 dB
Radiated Emission (Included Fundamental Emission) (30 MHz ~ 1 GHz)	4.00 dB
Radiated Emission (Included Fundamental Emission) (1 GHz to 26 GHz)	5.78 dB (1 GHz ~ 18 GHz)
	5.23 dB (18 GHz ~ 26 GHz)
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of k=2.	

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

EUT Name:	Sound Tower	
FCC Model	MX-ST4**, MX-ST4***** (“*” represents any alphanumeric character, “-”, “/” or Blank)	
ISED Model	MX-ST40B, MX-ST4CB	
Model Difference	Their electrical circuit design, layout, components used and internal wiring are identical, Different model number and marketing purpose only.We select Sound Tower with model number “MX-ST40B” as the representative model for compliance test.	
Product Description	Operation Frequency	2402 MHz ~ 2480 MHz
	Modulation Type	Data Rate
	GFSK	1Mbps
Power Supply	100-240V~ or 110-120V~ or 110-127V~ or 110-240V~,50/60 Hz, 40 W	

5.2. CHANNEL LIST

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	11	2424	22	2446	33	2468
1	2404	12	2426	23	2448	34	2470
2	2406	13	2428	24	2450	35	2472
3	2408	14	2430	25	2452	36	2474
4	2410	15	2432	26	2454	37	2476
5	2412	16	2434	27	2456	38	2478
6	2414	17	2436	28	2458	39	2480
7	2416	18	2438	29	2460	/	/
8	2418	19	2440	30	2462	/	/
9	2420	20	2442	31	2464	/	/
10	2422	21	2444	32	2468	/	/

5.3. MAXIMUM PEAK OUTPUT POWER

Test Mode	Frequency (MHz)	Channel Number	Maximum Peak Output Power (dBm)	Maximum EIRP (dBm)
BLE_1M	2402 ~ 2480	0-39[40]	2.96	6.39

5.4. TEST CHANNEL CONFIGURATION

Test Mode	Test Channel	Frequency
BLE_1M	CH 0(Low Channel), CH 19(MID Channel), CH 39(High Channel)	2402 MHz, 2440 MHz, 2480 MHz

5.5. THE WORSE CASE POWER SETTING PARAMETER

The Worse Case Power Setting Parameter under 2400 ~ 2483.5MHz Band				
Test Software Version		Bluetest3		
Modulation Type	Transmit Antenna Number	Test Software setting value		
		CH 0	CH 19	CH 39
GFSK(1Mbps)	1	default	default	default

5.6. DESCRIPTION OF AVAILABLE ANTENNAS

Antenna	Frequency (MHz)	Antenna Type	MAX Antenna Gain (dBi)
1	2402-2480	PCB	3.43

Test Modulation	Transmit and Receive Mode	Description
GFSK(1Mbps)	1TX, 1RX	Chain 1 can be used as transmitting/receiving antenna.
Note: The value of the antenna gain was declared by customer.		

5.7. WORST-CASE CONFIGURATIONS

Test Mode	Modulation Type	Data Rate (Mbps)
BLE_1M	GFSK	1Mbit/s

5.8. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	Remarks
1	Laptop	Lenovo	E42	/
2	Mobile Phone	Apple	A1699	/
3	Mobile Phone	HUAWEI	ALP-AL00	/
4	Speaker	Behringer	Ms20	/
5	USB Disk	Kingston	DTSE9H/8GB	8GB

I/O CABLES

Item	Type of cable	Shielded Type	Ferrite Core	Specification
1	Audo Cable	NO	NO	1.0m
2	Audio Cable	NO	NO	1.5m
3	USB out cable	YES	NO	1.0m
4	AC Cable	NO	NO	1.5m

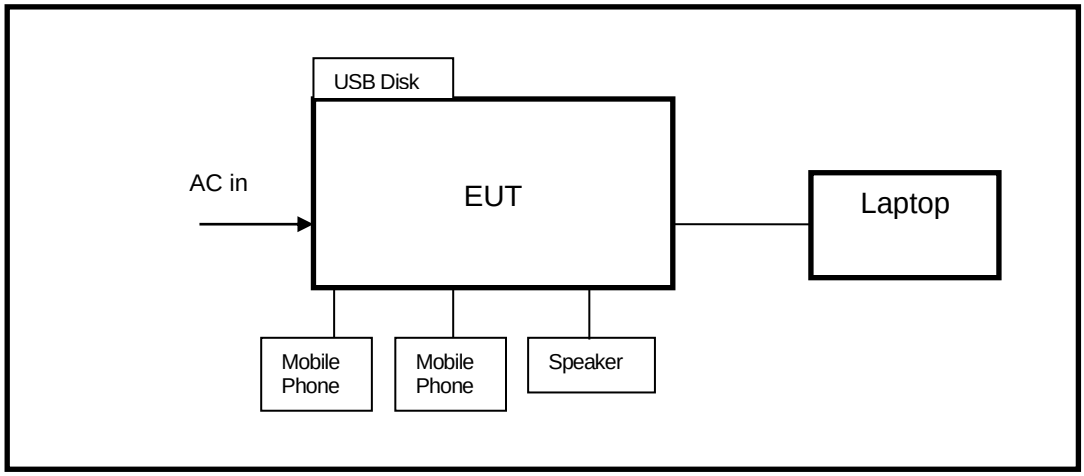
ACCESSORIES

Item	Accessory	Brand Name	Model Name	Description
1	Remote control	SAMSUNG	N/A	N/A

TEST SETUP

The EUT can work in an engineer mode with software through a laptop before the testing.

SETUP DIAGRAM FOR TESTS



6. MEASURING INSTRUMENT AND SOFTWARE USED

R&S TS 8997 Test System					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Due. Date
Power sensor, Power Meter	R&S	OSP120	100921	Mar.23,2021	Mar.22,2022
Vector Signal Generator	R&S	SMBV100A	261637	Oct.30, 2021	Oct.29, 2022
Signal Generator	R&S	SMB100A	178553	Oct.30, 2021	Oct.29, 2022
Signal Analyzer	R&S	FSV40	101118	Oct.30, 2021	Oct.29, 2022
Software					
Description	Manufacturer	Name	Version		
For R&S TS 8997 Test System	Rohde & Schwarz	EMC 32	10.60.10		

Tonsend RF Test System					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Due. Date
Wideband Radio Communication Tester	R&S	CMW500	155523	Oct.30, 2021	Oct.29, 2022
Wireless Connectivity Tester	R&S	CMW270	1201.0002N75-102	Sep.29, 2021	Sep.28, 2022
PXA Signal Analyzer	Keysight	N9030A	MY55410512	Oct.30, 2021	Oct.29, 2022
MXG Vector Signal Generator	Keysight	N5182B	MY56200284	Oct.30, 2021	Oct.29, 2022
MXG Vector Signal Generator	Keysight	N5172B	MY56200301	Oct.30, 2021	Oct.29, 2022
DC power supply	Keysight	E3642A	MY55159130	Oct.30, 2021	Oct.29, 2022
Temperature & Humidity Chamber	SANMOOD	SG-80-CC-2	2088	Nov.20,2020	Nov.19,2022
Software					
Description	Manufacturer	Name	Version		
Tonsend SRD Test System	Tonsend	JS1120-3 RF Test System	2.6.77.0518		

Radiated Emissions					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Due Date
MXE EMI Receiver	KESIGHT	N9038A	MY56400036	Oct.30, 2021	Oct.29, 2022
Hybrid Log Periodic Antenna	TDK	HLP-3003C	130959	Aug.02, 2021	Aug.01, 2024
Preamplifier	HP	8447D	2944A09099	Oct.30, 2021	Oct.29, 2022
EMI Measurement Receiver	R&S	ESR26	101377	Oct.30, 2021	Oct.29, 2022
Horn Antenna	TDK	HRN-0118	130940	July 20, 2021	July 19, 2024
Preamplifier	TDK	PA-02-0118	TRS-305-00067	Oct.30, 2021	Oct.29, 2022
Horn Antenna	Schwarzbeck	BBHA9170	697	July 20, 2021	July 19, 2024
Preamplifier	TDK	PA-02-2	TRS-307-00003	Oct.31, 2021	Oct.30, 2022
Preamplifier	TDK	PA-02-3	TRS-308-00002	Oct.31, 2021	Oct.30, 2022
Loop antenna	Schwarzbeck	1519B	00008	Dec.14, 2021	Dec.17,2024
Preamplifier	TDK	PA-02-001-3000	TRS-302-00050	Oct.31, 2021	Oct.30, 2022
Preamplifier	Mini-Circuits	ZX60-83LN-S+	SUP01201941	Oct.31, 2021	Oct.30, 2022
High Pass Filter	Wi	WHKX10-2700-3000-18000-40SS	23	Oct.31, 2021	Oct.30, 2022
Band Reject Filter	Wainwright	WRCJV8-2350-2400-2483.5-2533.5-40SS	4	Oct.31, 2021	Oct.30, 2022
Software					
Description			Manufacturer	Name	Version
Test Software for Radiated Emissions			Farad	EZ-EMC	Ver. UL-3A1

7. ANTENNA PORT TEST RESULTS

7.1. ON TIME AND DUTY CYCLE

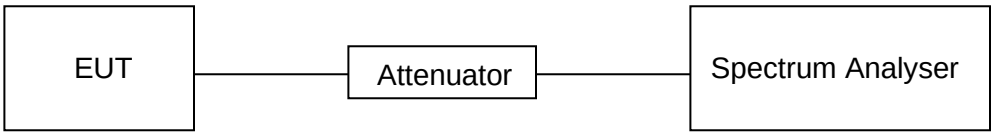
LIMITS

None; for reporting purposes only.

PROCEDURE

Refer to ANSI C63.10-2013 clause 11.6 Zero – Span Spectrum Analyzer method.

TEST SETUP



TEST ENVIRONMENT

Temperature	23.4 °C	Relative Humidity	58.1 %
Atmosphere Pressure	101 kPa	Test Voltage	AC 120 V, 60 HZ

RESULTS

Please refer to appendix G.

7.2. 6 dB DTS BANDWIDTH AND 99 % OCCUPIED BANDWIDTH

LIMITS

CFR 47FCC Part15 (15.247) Subpart C ISED RSS-247 ISSUE 2			
Section	Test Item	Limit	Frequency Range (MHz)
CFR 47 FCC 15.247(a)(2) ISED RSS-247 5.2 (a)	6 dB Bandwidth	≥ 500 kHz	2400-2483.5
ISED RSS-Gen Clause 6.7	99 % Occupied Bandwidth	None; for reporting purposes only.	2400-2483.5

TEST PROCEDURE

Refer to ANSI C63.10-2013 clause 11.8 for DTS bandwidth and clause 6.9 for Occupied Bandwidth.

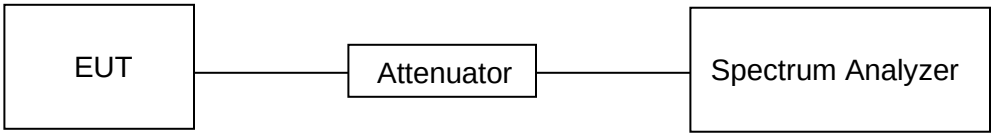
Connect the EUT to the spectrum analyser and use the following settings:

Center Frequency	The center frequency of the channel under test
Frequency Span	For 6 dB Bandwidth: Enough to capture all products of the modulation carrier emission For 99 % Occupied Bandwidth: Between 1.5 times and 5.0 times the OBW
Detector	Peak
RBW	For 6 dB Bandwidth: 100 kHz For 99 % Occupied Bandwidth: 1 % to 5 % of the occupied bandwidth
VBW	For 6 dB Bandwidth: ≥3 × RBW For 99 % Occupied Bandwidth: ≥3 × RBW
Trace	Max hold
Sweep	Auto couple

a) Use the 99 % power bandwidth function of the instrument, allow the trace to stabilize and report the measured bandwidth.

b) Allow the trace to stabilize and measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

TEST SETUP



TEST ENVIRONMENT

Temperature	23.4 °C	Relative Humidity	58.1 %
Atmosphere Pressure	101 kPa	Test Voltage	AC 120 V, 60 HZ

RESULTS

Please refer to appendix A & B.

7.3. CONDUCTED OUTPUT POWER

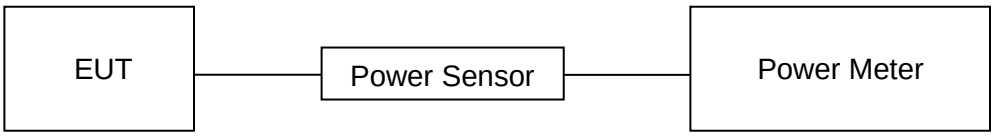
LIMITS

CFR 47 FCC Part15 (15.247) Subpart C ISED RSS-247 ISSUE 2			
Section	Test Item	Limit	Frequency Range (MHz)
CFR 47 FCC 15.247(b)(3) ISED RSS-247 5.4 (d)	Peak Conducted Output Power	1 watt or 30 dBm	2400-2483.5

TEST PROCEDURE

Connect the EUT to a low loss RF cable from the antenna port to the power sensor (video bandwidth is greater than the occupied bandwidth).
Measure peak emission level, the indicated level is the peak output power, after any corrections for external attenuators and cables.

TEST SETUP



TEST ENVIRONMENT

Temperature	23.4 °C	Relative Humidity	58.1 %
Atmosphere Pressure	101 kPa	Test Voltage	AC 120 V, 60 HZ

RESULTS

Please refer to appendix C.

7.4. POWER SPECTRAL DENSITY

LIMITS

CFR 47 FCC Part15 (15.247) Subpart C ISED RSS-247 ISSUE 2			
Section	Test Item	Limit	Frequency Range (MHz)
CFR 47 FCC §15.247 (e) ISED RSS-247 5.2 (b)	Power Spectral Density	8 dBm in any 3 kHz band	2400-2483.5

TEST PROCEDURE

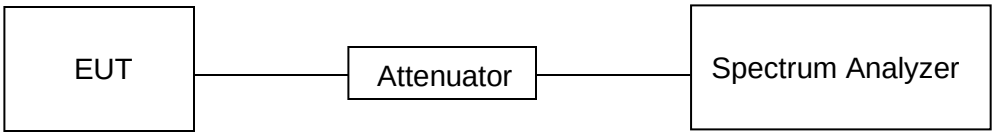
Refer to ANSI C63.10-2013 clause 11.10.

Connect the EUT to the spectrum analyser and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	3 kHz ≤ RBW ≤ 100 kHz
VBW	≥3 × RBW
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple

Allow trace to fully stabilize and use the peak marker function to determine the maximum amplitude level within the RBW.
If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

TEST SETUP



TEST ENVIRONMENT

Temperature	23.4 °C	Relative Humidity	58.1 %
Atmosphere Pressure	101 kPa	Test Voltage	AC 120 V, 60 HZ

RESULTS

Please refer to appendix D.

7.5. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

LIMITS

CFR 47 FCC Part15 (15.247) Subpart C ISED RSS-247 ISSUE 2		
Section	Test Item	Limit
CFR 47 FCC §15.247 (d) ISED RSS-247 5.5	Conducted Bandedge and Spurious Emissions	at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power

TEST PROCEDURE

Refer to ANSI C63.10-2013 clause 11.11 and 11.13.

Connect the EUT to the spectrum analyser and use the following settings for reference level measurement:

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	100 kHz
VBW	≥3 × RBW
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple.

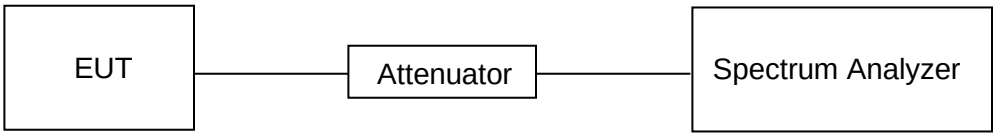
Allow trace to fully stabilize and use the peak marker function to determine the maximum PSD level.

Change the settings for emission level measurement:

Span	Set the center frequency and span to encompass frequency range to be measured
Detector	Peak
RBW	100 kHz
VBW	≥3 × RBW
measurement points	≥span/RBW
Trace	Max hold
Sweep time	Auto couple.

Allow trace to fully stabilize and use the peak marker function to determine the maximum PSD level. Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements specified in 11.11.

TEST SETUP



TEST ENVIRONMENT

Temperature	23.4 °C	Relative Humidity	58.1 %
Atmosphere Pressure	101 kPa	Test Voltage	AC 120 V, 60 HZ

RESULTS

Please refer to appendix E & F.

8. RADIATED TEST RESULTS

LIMITS

Please refer to CFR 47 FCC §15.205 and §15.209.

Please refer to ISED RSS-GEN Clause 8.9 and Clause 8.10.

Radiation Disturbance Test Limit for FCC (Class B) (9 kHz-1 GHz)

Emissions radiated outside of the specified frequency bands above 30 MHz			
Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m	
		Quasi-Peak	
30 - 88	100	40	
88 - 216	150	43.5	
216 - 960	200	46	
Above 960	500	54	
Above 1000	500	Peak	Average
		74	54

FCC Emissions radiated outside of the specified frequency bands below 30 MHz		
Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30

ISED General field strength limits at frequencies below 30 MHz

Table 6 – General field strength limits at frequencies below 30 MHz

Frequency	Magnetic field strength (H-Field) (µA/m)	Measurement distance (m)
9 - 490 kHz[Note 1]	6.37/F (F in kHz)	300
490 - 1705 kHz	63.7/F (F in kHz)	30
1.705 - 30 MHz	0.08	30

Note 1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

ISED Restricted bands please refer to ISED RSS-GEN Clause 8.10

Table 7 – Restricted frequency bands[Note 1]		
MHz	MHz	GHz
0.090 - 0.110	149.9 - 150.05	9.0 - 9.2
0.495 - 0.505	156.52475 - 156.52525	9.3 - 9.5
2.1735 - 2.1905	156.7 - 156.9	10.6 - 12.7
3.020 - 3.026	162.0125 - 167.17	13.25 - 13.4
4.125 - 4.128	167.72 - 173.2	14.47 - 14.5
4.17725 - 4.17775	240 – 285	15.35 - 16.2
4.20725 - 4.20775	322 - 335.4	17.7 - 21.4
5.677 - 5.683	399.9 - 410	22.01 - 23.12
6.215 - 6.218	608 - 614	23.6 - 24.0
6.26775 - 6.26825	960 - 1427	31.2 - 31.8
6.31175 - 6.31225	1435 - 1626.5	36.43 - 36.5
8.291 - 8.294	1645.5 - 1646.5	Above 38.6
8.362 - 8.366	1660 - 1710	
8.37625 - 8.38675	1718.8 - 1722.2	
8.41425 - 8.41475	2200 - 2300	
12.29 - 12.293	2310 - 2390	
12.51975 - 12.52025	2483.5 - 2500	
12.57675 - 12.57725	2655 - 2900	
13.36 - 13.41	3260 – 3267	
16.42 - 16.423	3332 - 3339	
16.69475 - 16.69525	3345.8 - 3358	
16.80425 - 16.80475	3500 - 4400	
25.5 - 25.67	4500 - 5150	
37.5 - 38.25	5350 - 5460	
73 - 74.6	7250 - 7750	
74.8 - 75.2	8025 – 8500	
108 – 138		

Note 1: Certain frequency bands listed in table 7 and in bands above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of RSSs.

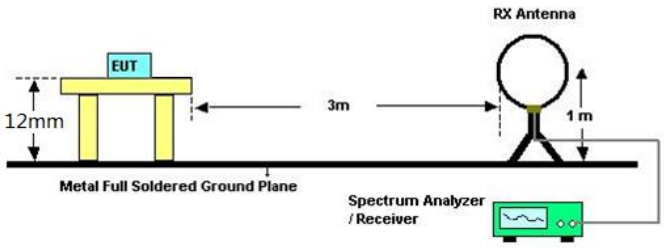
FCC Restricted bands of operation refer to FCC §15.205 (a):

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1]0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	([2])
13.36-13.41			

Note: [1]Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2]Above 38.6c

TEST SETUP AND PROCEDURE

Below 30 MHz



The setting of the spectrum analyser

RBW	200 Hz (From 9 kHz to 0.15 MHz)/ 9 kHz (From 0.15 MHz to 30 MHz)
VBW	200 Hz (From 9 kHz to 0.15 MHz)/ 9 kHz (From 0.15 MHz to 30 MHz)
Sweep	Auto

1. The testing follows the guidelines in ANSI C63.10-2013 clause 6.4.

2. The EUT was arranged to its worst case and then turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both Horizontal, Face-on and Face-off polarizations of the antenna are set to make the measurement.

3. The EUT was placed on a turntable with 12 mm above ground.

4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a 1 m height antenna tower.

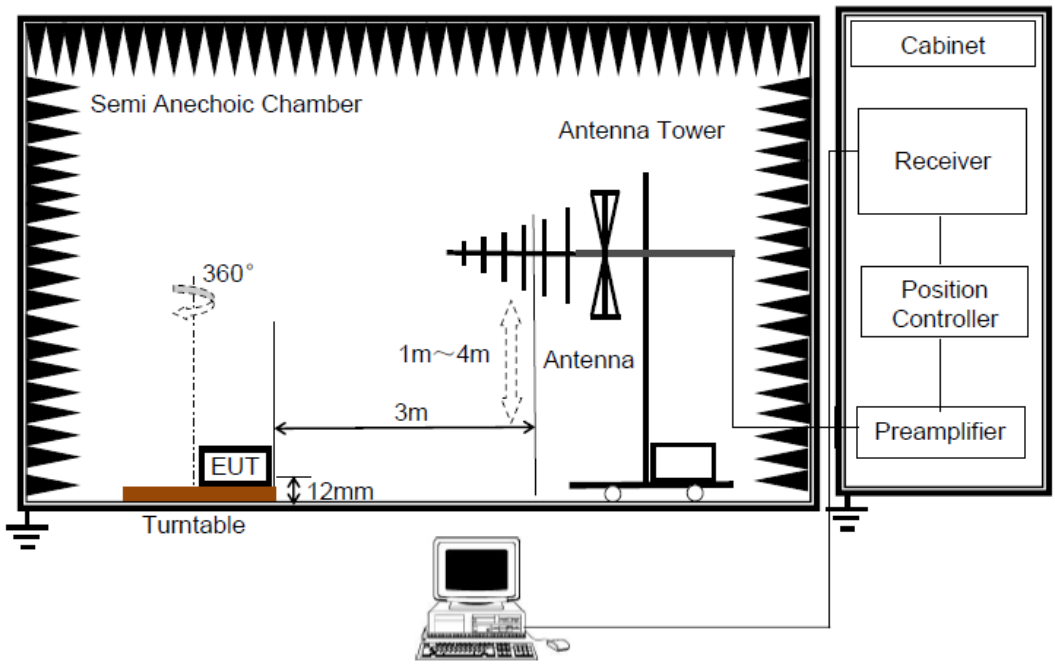
5. The radiated emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector.

6. For measurement below 1 GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak and average detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak and average detector and reported.

7. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field site based on KDB 414788.

8. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω. For example, the measurement frequency X KHz resulted in a level of Y dBuV/m, which is equivalent to Y-51.5 = Z dBuA/m, which has the same margin, W dB, to the corresponding RSS-GEN Table 6 limit as it has to be 15.209(a) limit.

Below 1 GHz and above 30 MHz



The setting of the spectrum analyser

RBW	120 kHz
VBW	300 kHz
Sweep	Auto
Detector	Peak/QP
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013 clause 6.5.

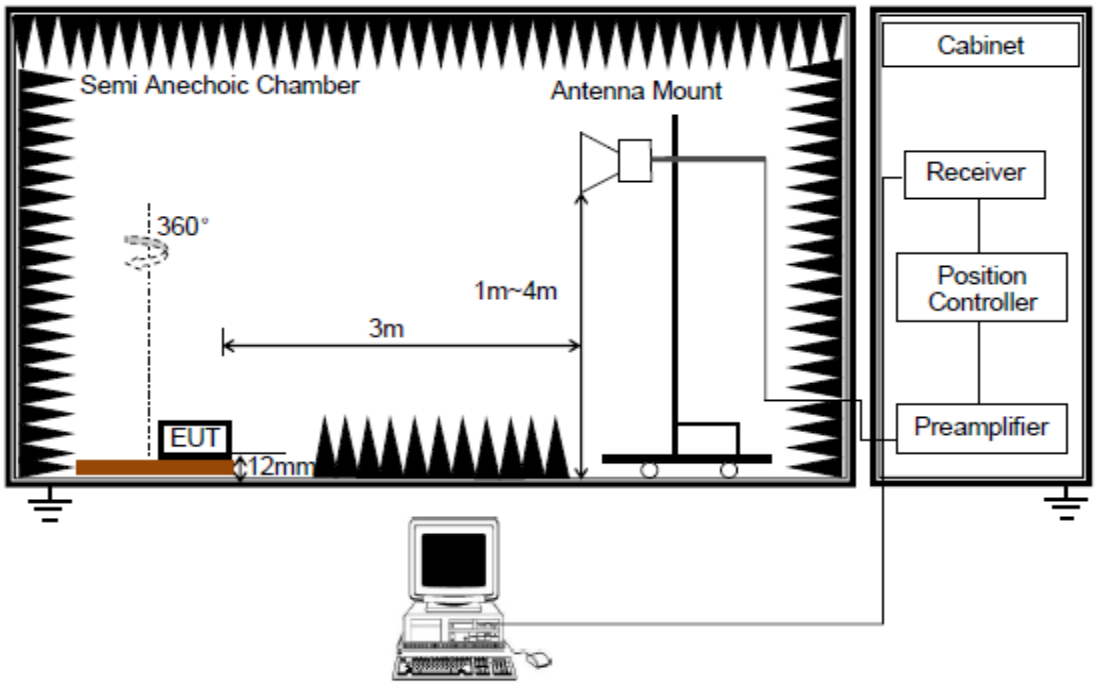
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

3. The EUT was placed on a turntable with 12 mm above ground.

4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

5. For measurement below 1 GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

Above 1GHz



The setting of the spectrum analyser

RBW	1 MHz
VBW	PEAK: 3 MHz AVG: see note 6
Sweep	Auto
Detector	Peak
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013 clause 6.6.

2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

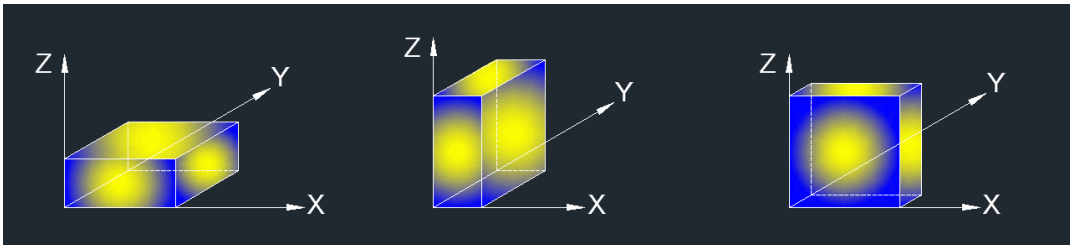
3. The EUT was placed on a turntable with 12 mm above ground.

4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

5. For measurement above 1 GHz, the emission measurement will be measured by the peak detector. This peak level, once corrected, must comply with the limit specified in Section 15.209.

6. For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector for average measurements. For the Duty Cycle please refer to clause 7.1.ON TIME AND DUTY CYCLE.

X axis, Y axis, Z axis positions:



Note 1: For all radiated test, EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

Note 2: The EUT was fully exercised with external accessories during the test. In the case of multiple accessory external ports, an external accessory shall be connected to one of each type of port.

TEST ENVIRONMENT

Temperature	24.3 °C	Relative Humidity	61 %
Atmosphere Pressure	101 kPa	Test Voltage	AC 120 V, 60 HZ

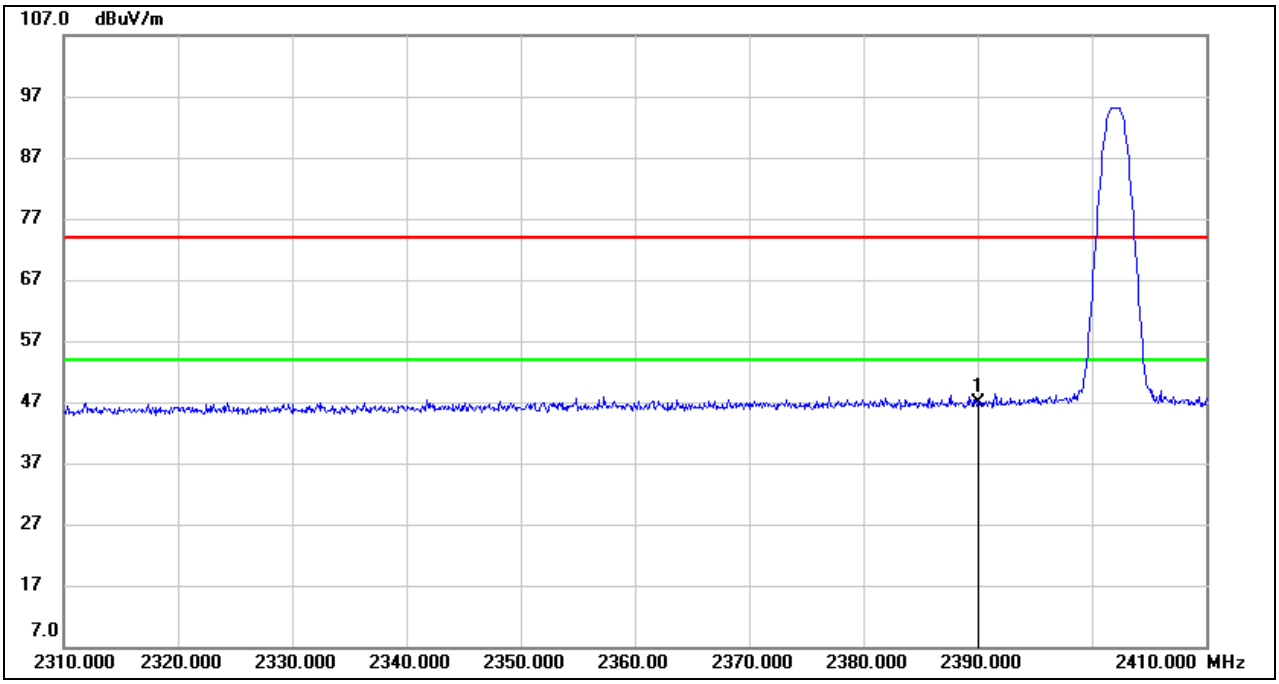
RESULTS

8.1. RESTRICTED BANDEDGE

8.1.1. LE 1M MODE

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

PEAK

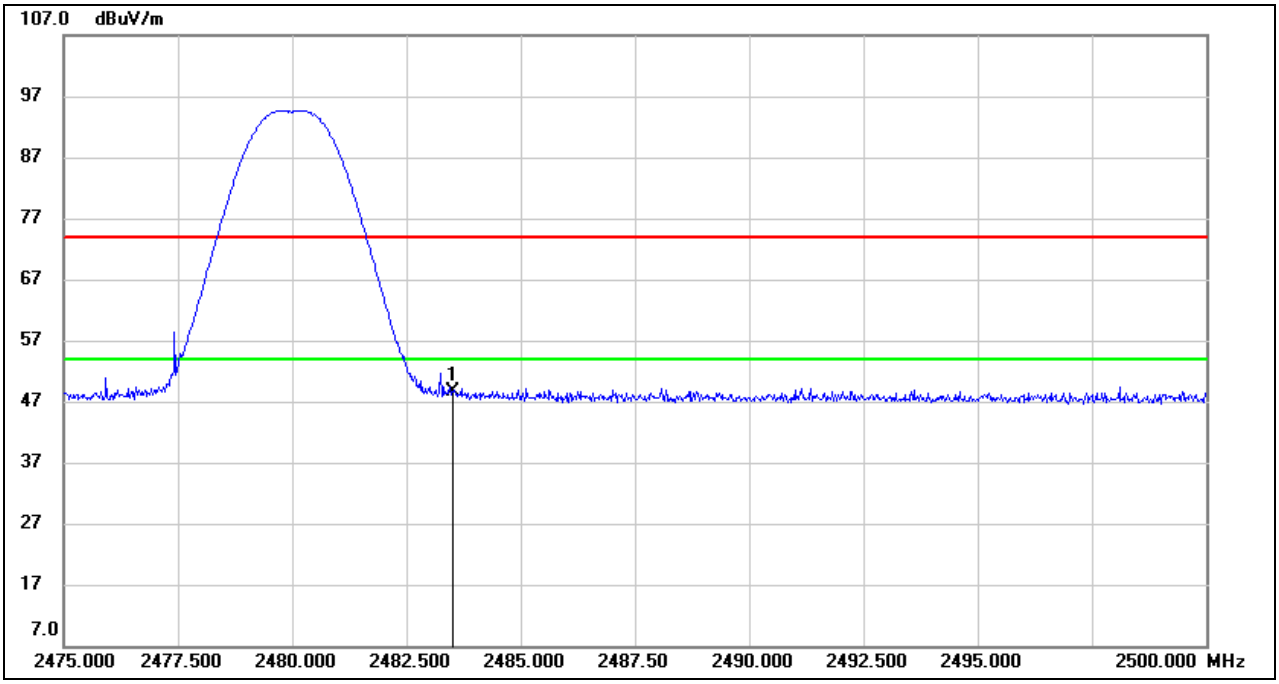


No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2390.000	14.24	32.66	46.90	74.00	-27.10	peak

Note: 1. Measurement = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. Only the worst data was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

PEAK



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	15.60	33.10	48.70	74.00	-25.30	peak

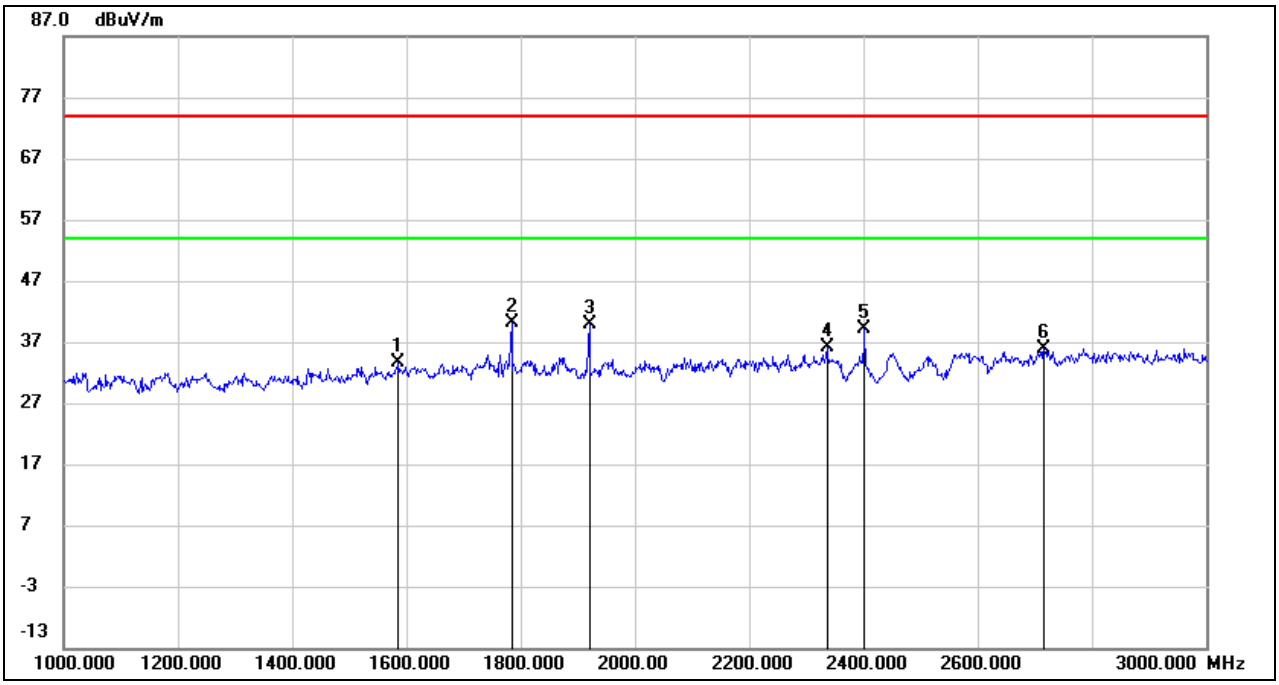
Note: 1. Measurement = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. Only the worst data was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

Note: All the polarities (Vertical & Horizontal) had been tested, only the worst data was recorded in the report.

8.2. SPURIOUS EMISSIONS (1 GHz ~ 3 GHz)

8.2.1. LE 1M MODE

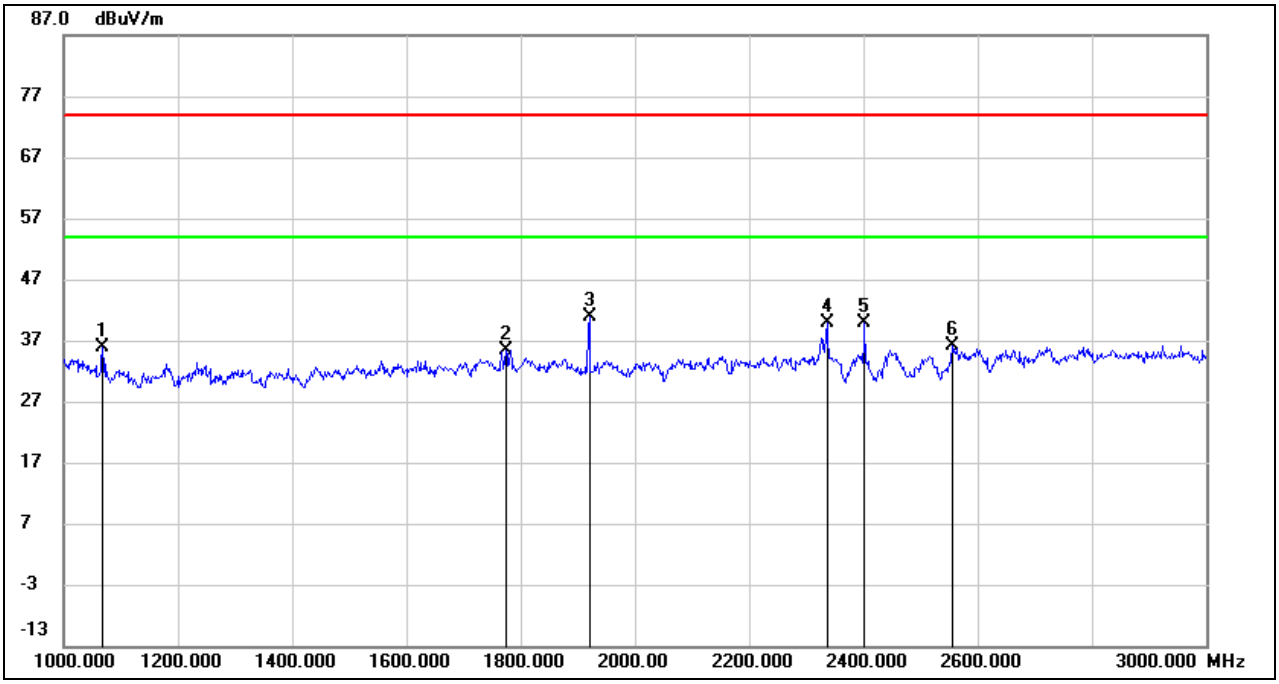
HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1587.000	45.58	-12.06	33.52	74.00	-40.48	peak
2	1784.000	50.91	-10.86	40.05	74.00	-33.95	peak
3	1920.000	50.98	-11.02	39.96	74.00	-34.04	peak
4	2336.000	45.44	-9.34	36.10	74.00	-37.90	peak
5	2402.000	48.26	-9.06	39.20	/	/	Fundamental
6	2716.000	43.94	-8.09	35.85	74.00	-38.15	peak

Note:
1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for Band reject filter losses.
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

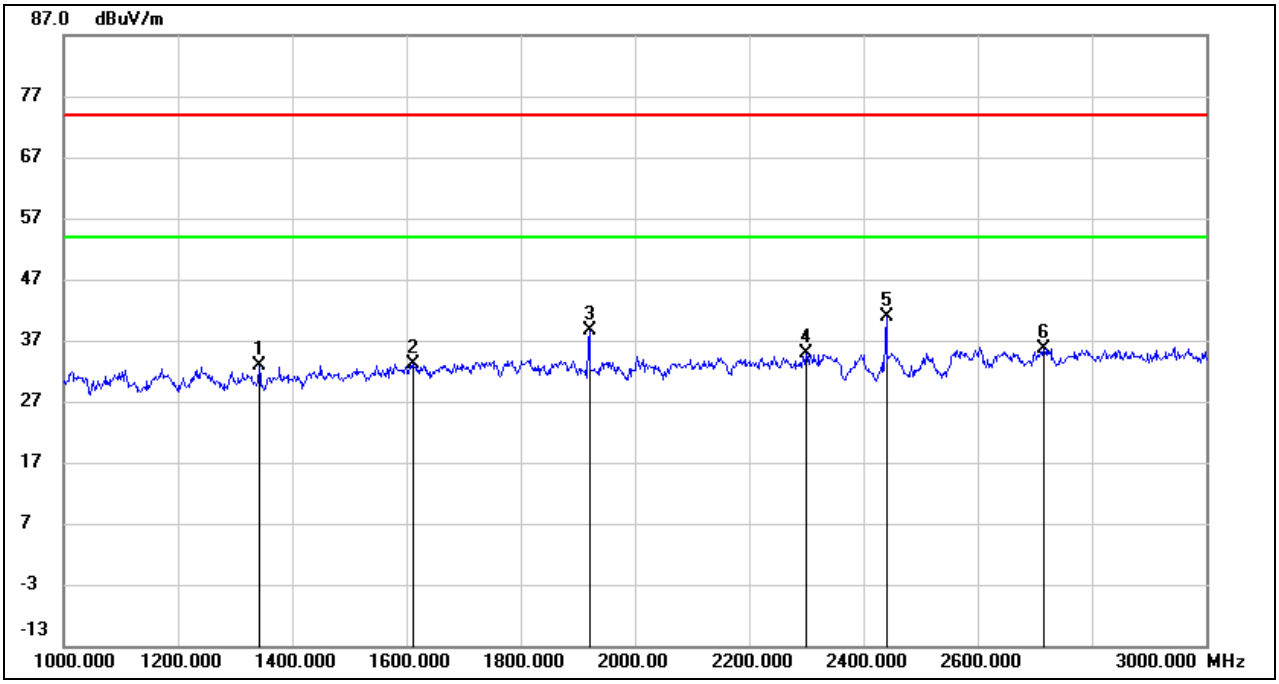
HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, VERTICAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1068.000	50.53	-14.63	35.90	74.00	-38.10	peak
2	1775.000	46.33	-10.92	35.41	74.00	-38.59	peak
3	1920.000	51.84	-11.02	40.82	74.00	-33.18	peak
4	2337.000	49.21	-9.33	39.88	74.00	-34.12	peak
5	2402.000	48.92	-9.06	39.86	/	/	Fundamental
6	2557.000	44.76	-8.73	36.03	74.00	-37.97	peak

Note:
1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for Band reject filter losses.
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

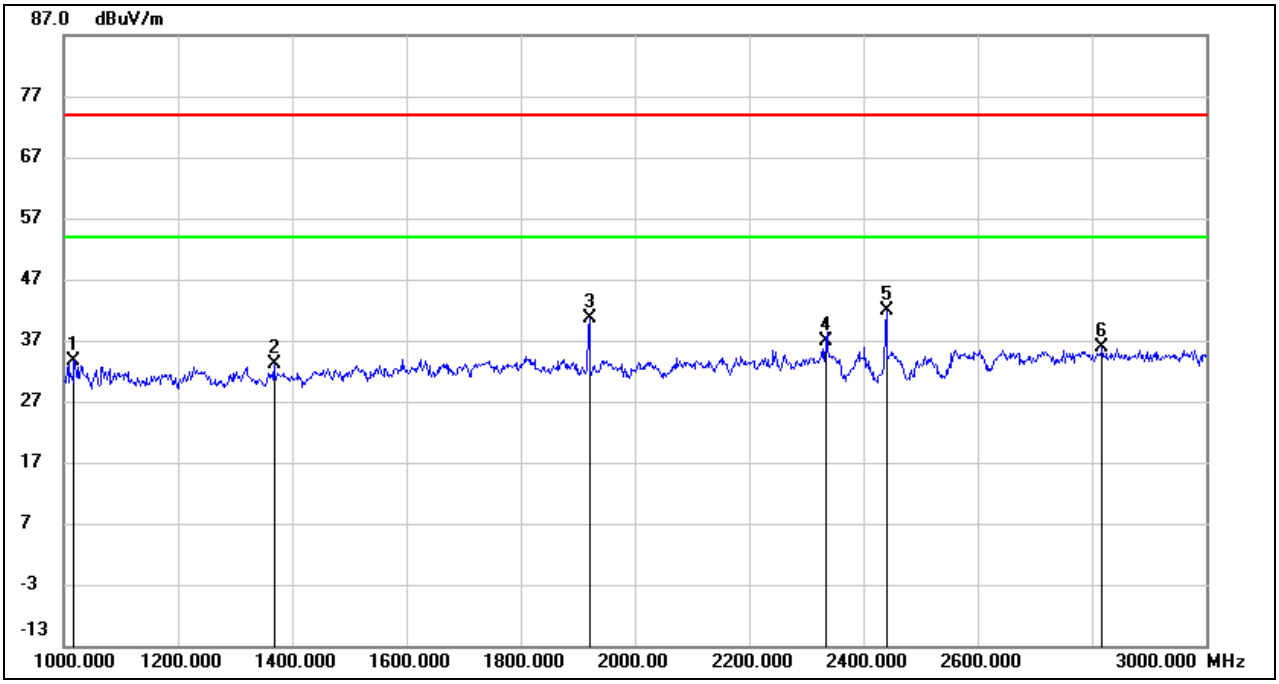
HARMONICS AND SPURIOUS EMISSIONS (MID CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1342.000	46.23	-13.34	32.89	74.00	-41.11	peak
2	1612.000	45.13	-11.92	33.21	74.00	-40.79	peak
3	1920.000	49.73	-11.02	38.71	74.00	-35.29	peak
4	2301.000	44.36	-9.48	34.88	74.00	-39.12	peak
5	2440.000	49.88	-8.98	40.90	/	/	Fundamental
6	2716.000	43.70	-8.09	35.61	74.00	-38.39	peak

Note:
1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for Band reject filter losses.
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

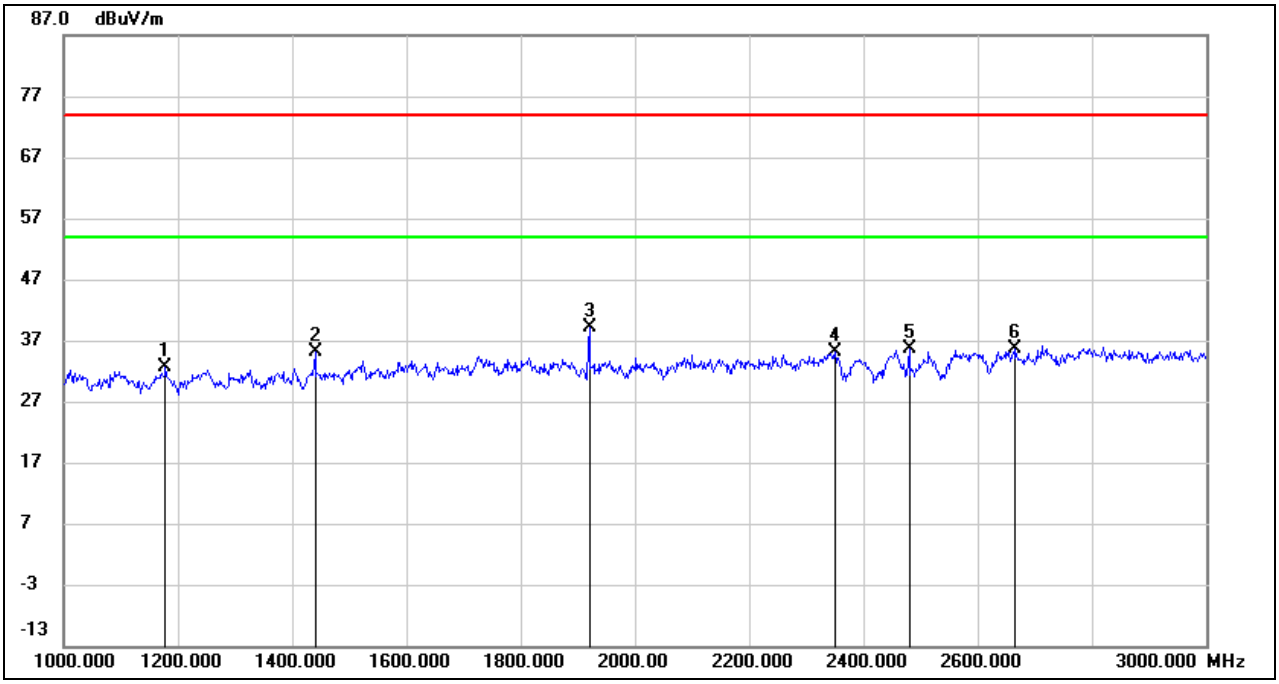
HARMONICS AND SPURIOUS EMISSIONS (MID CHANNEL, VERTICAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1019.000	48.57	-14.96	33.61	74.00	-40.39	peak
2	1368.000	46.30	-13.27	33.03	74.00	-40.97	peak
3	1920.000	51.61	-11.02	40.59	74.00	-33.41	peak
4	2335.000	46.18	-9.34	36.84	74.00	-37.16	peak
5	2440.000	50.79	-8.98	41.81	/	/	Fundamental
6	2819.000	43.47	-7.64	35.83	74.00	-38.17	peak

Note:
1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for Band reject filter losses.
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

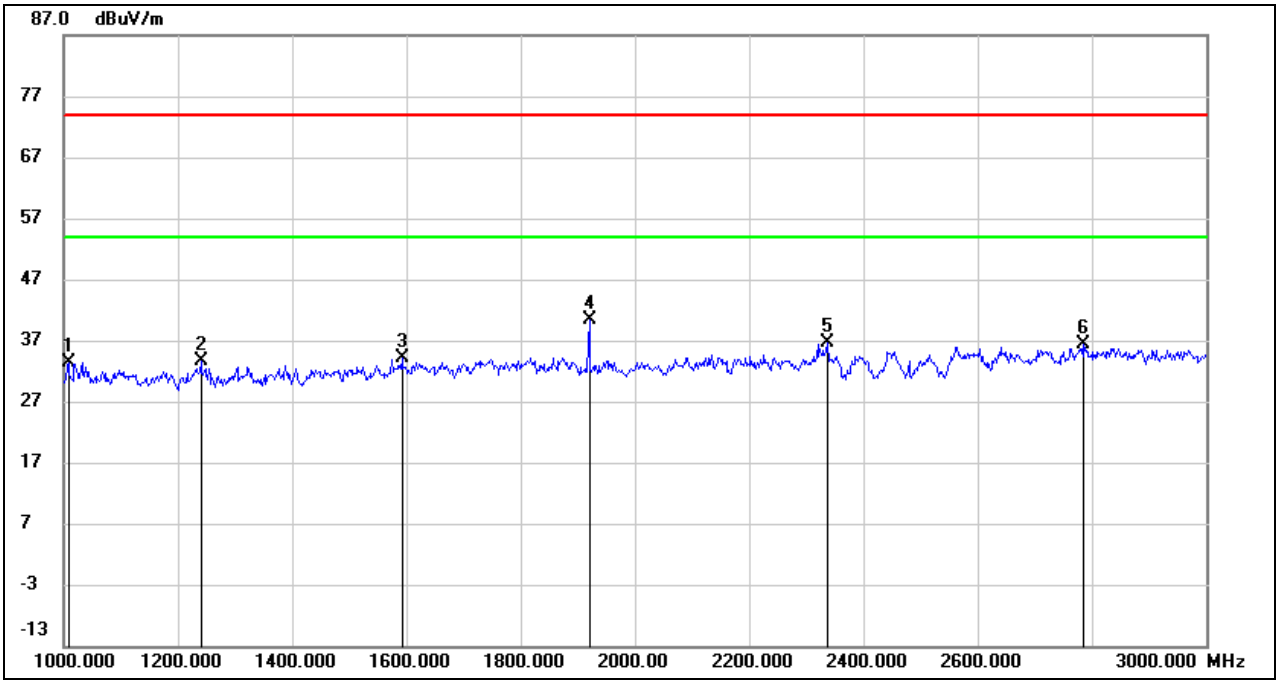
HARMONICS AND SPURIOUS EMISSIONS (HIGH CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1178.000	46.48	-13.91	32.57	74.00	-41.43	peak
2	1440.000	47.92	-12.90	35.02	74.00	-38.98	peak
3	1920.000	50.16	-11.02	39.14	74.00	-34.86	peak
4	2351.000	44.31	-9.27	35.04	74.00	-38.96	peak
5	2480.000	44.59	-8.87	35.72	/	/	Fundamental
6	2665.000	43.94	-8.33	35.61	74.00	-38.39	peak

Note:
1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for Band reject filter losses.
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

HARMONICS AND SPURIOUS EMISSIONS (HIGH CHANNEL, VERTICAL)



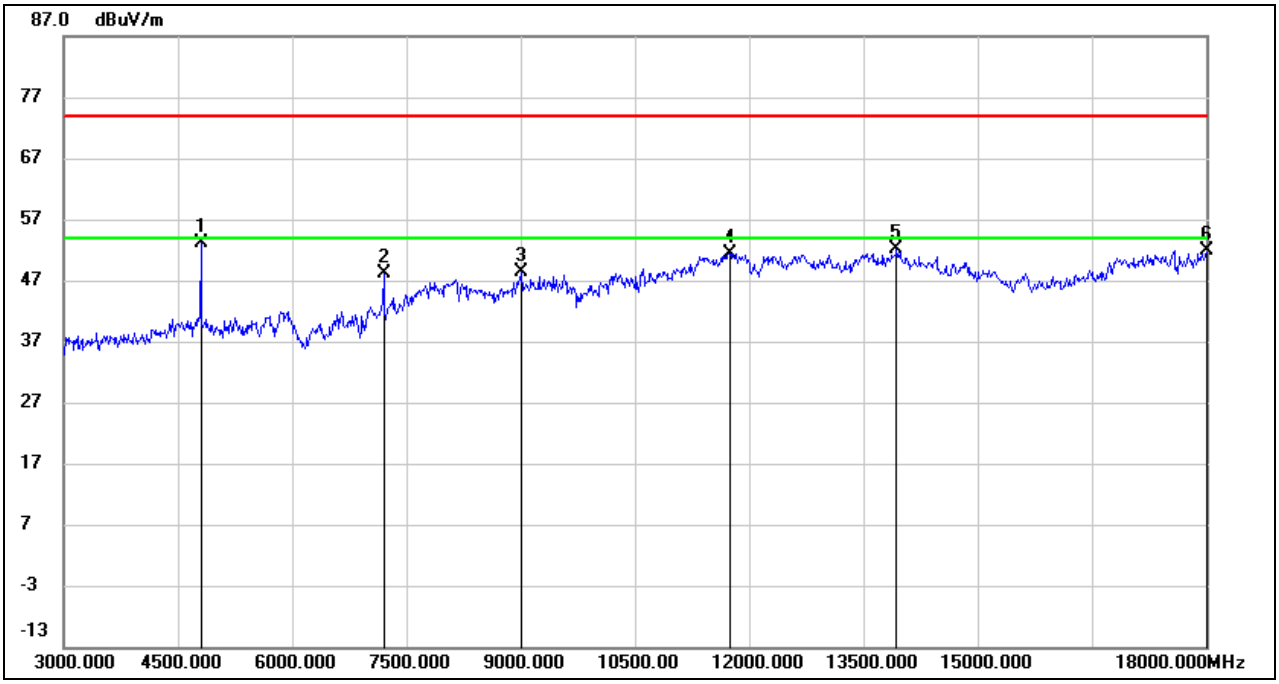
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1008.000	48.37	-15.02	33.35	74.00	-40.65	peak
2	1240.000	47.17	-13.65	33.52	74.00	-40.48	peak
3	1593.000	46.09	-12.03	34.06	74.00	-39.94	peak
4	1920.000	51.35	-11.02	40.33	74.00	-33.67	peak
5	2336.000	45.92	-9.34	36.58	74.00	-37.42	peak
6	2785.000	44.18	-7.77	36.41	74.00	-37.59	peak

Note:
1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for Band reject filter losses.
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

8.3. SPURIOUS EMISSIONS (3 GHz ~ 18 GHz)

8.3.1. LE 1M MODE

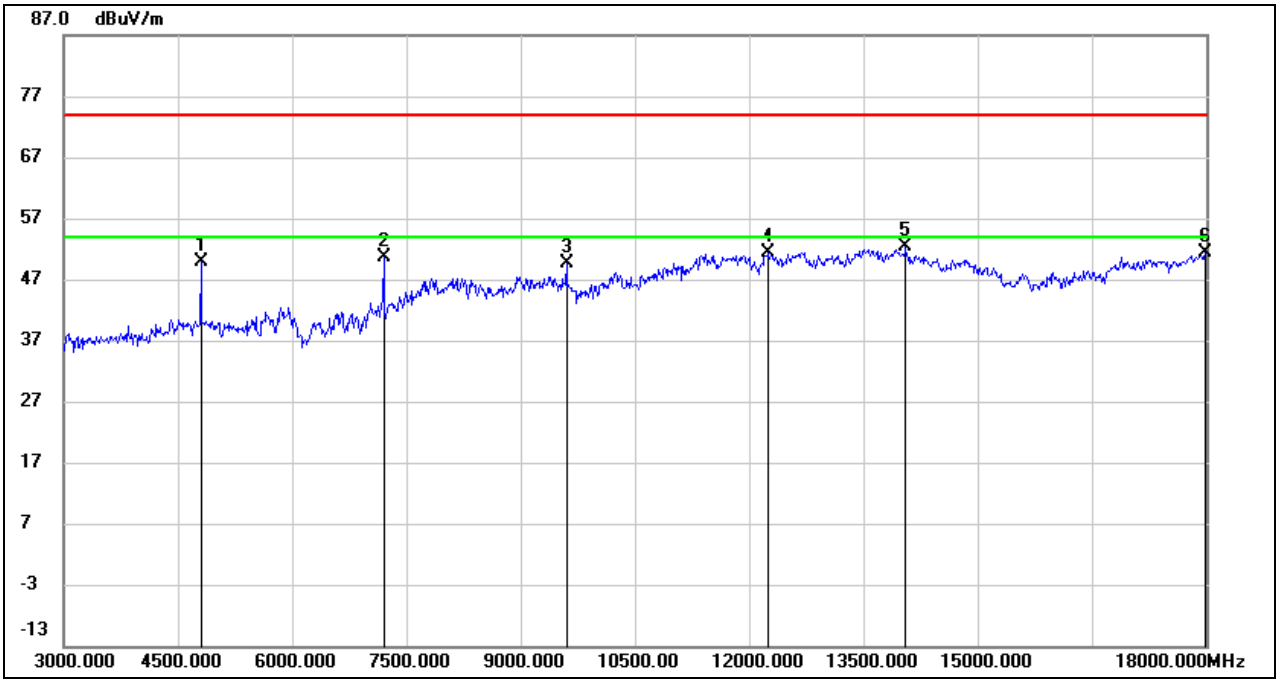
HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4800.000	52.88	0.16	53.04	74.00	-20.96	peak
2	7207.500	41.66	6.47	48.13	74.00	-25.87	peak
3	9022.500	37.93	10.53	48.46	74.00	-25.54	peak
4	11745.000	34.31	17.06	51.37	74.00	-22.63	peak
5	13942.500	32.70	19.32	52.02	74.00	-21.98	peak
6	18000.000	26.99	24.97	51.96	74.00	-22.04	peak

Note: 1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for High Pass Filter losses.
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

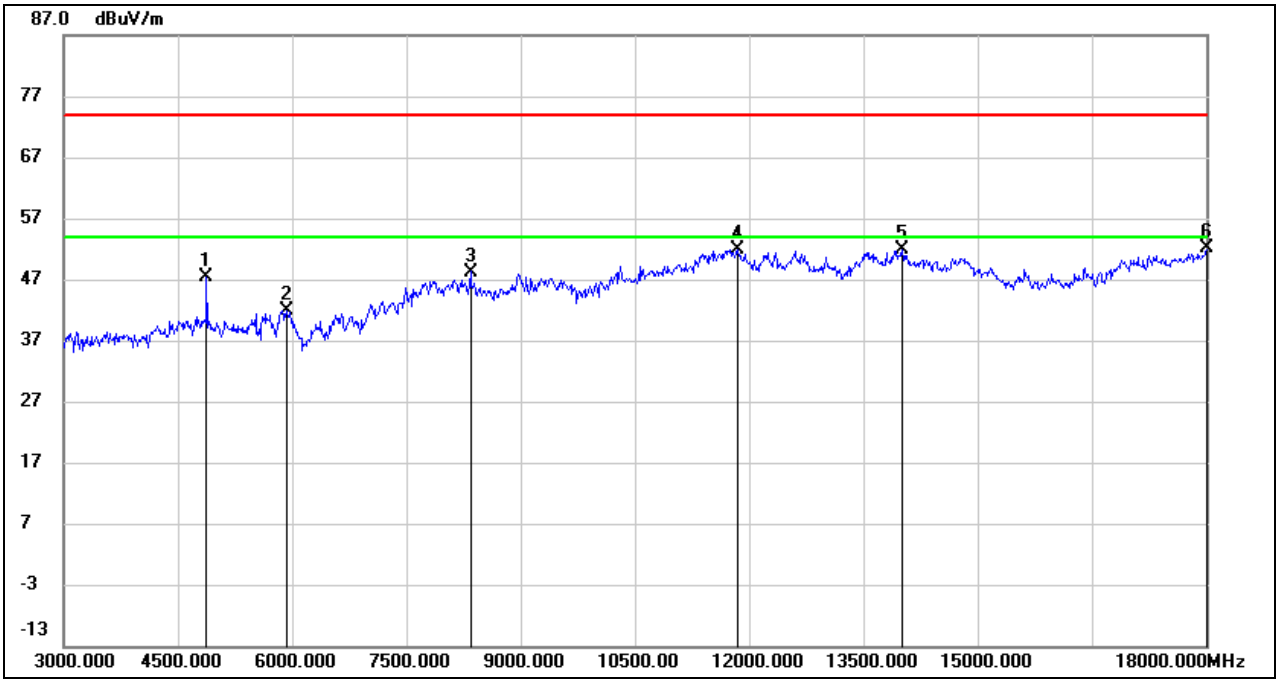
HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, VERTICAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4800.000	49.69	0.16	49.85	74.00	-24.15	peak
2	7207.500	44.06	6.47	50.53	74.00	-23.47	peak
3	9607.500	38.69	11.04	49.73	74.00	-24.27	peak
4	12262.500	33.86	17.53	51.39	74.00	-22.61	peak
5	14062.500	33.20	19.07	52.27	74.00	-21.73	peak
6	17992.500	26.48	24.92	51.40	74.00	-22.60	peak

Note: 1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for High Pass Filter losses.
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

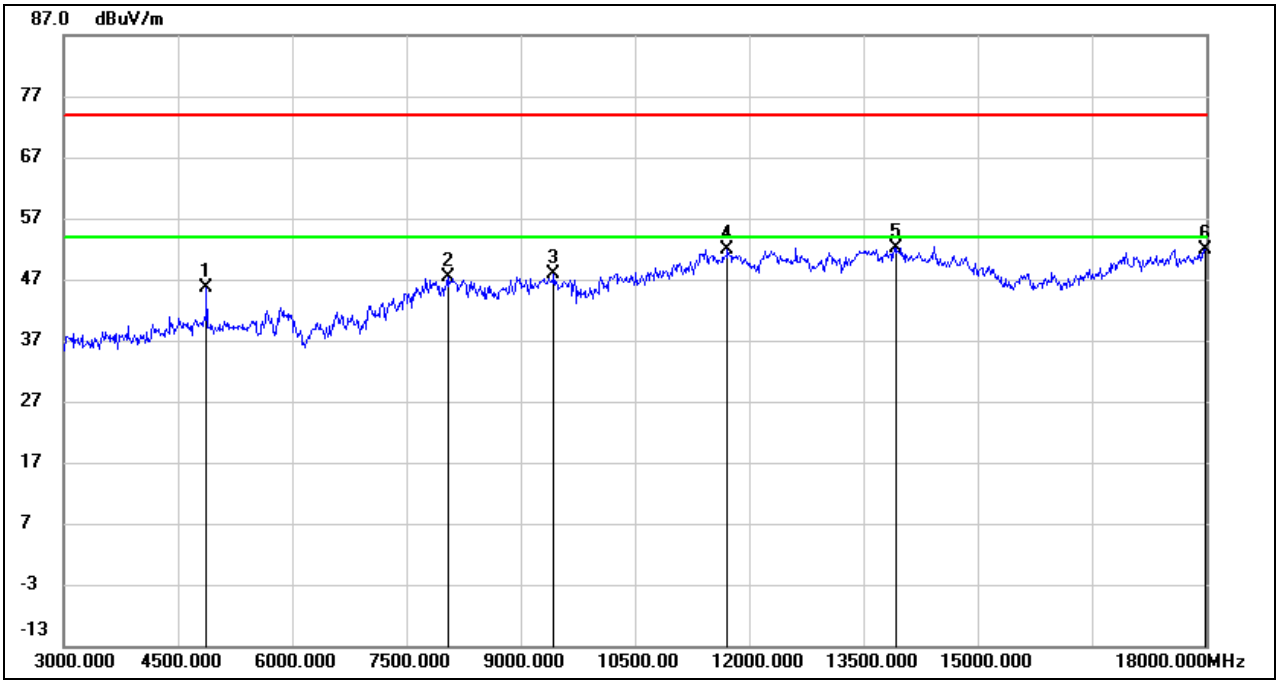
HARMONICS AND SPURIOUS EMISSIONS (MID CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4875.000	47.43	0.02	47.45	74.00	-26.55	peak
2	5932.500	38.63	3.26	41.89	74.00	-32.11	peak
3	8340.000	39.37	8.88	48.25	74.00	-25.75	peak
4	11850.000	34.72	17.11	51.83	74.00	-22.17	peak
5	14017.500	32.60	19.28	51.88	74.00	-22.12	peak
6	18000.000	27.11	24.97	52.08	74.00	-21.92	peak

Note: 1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for High Pass Filter losses.
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

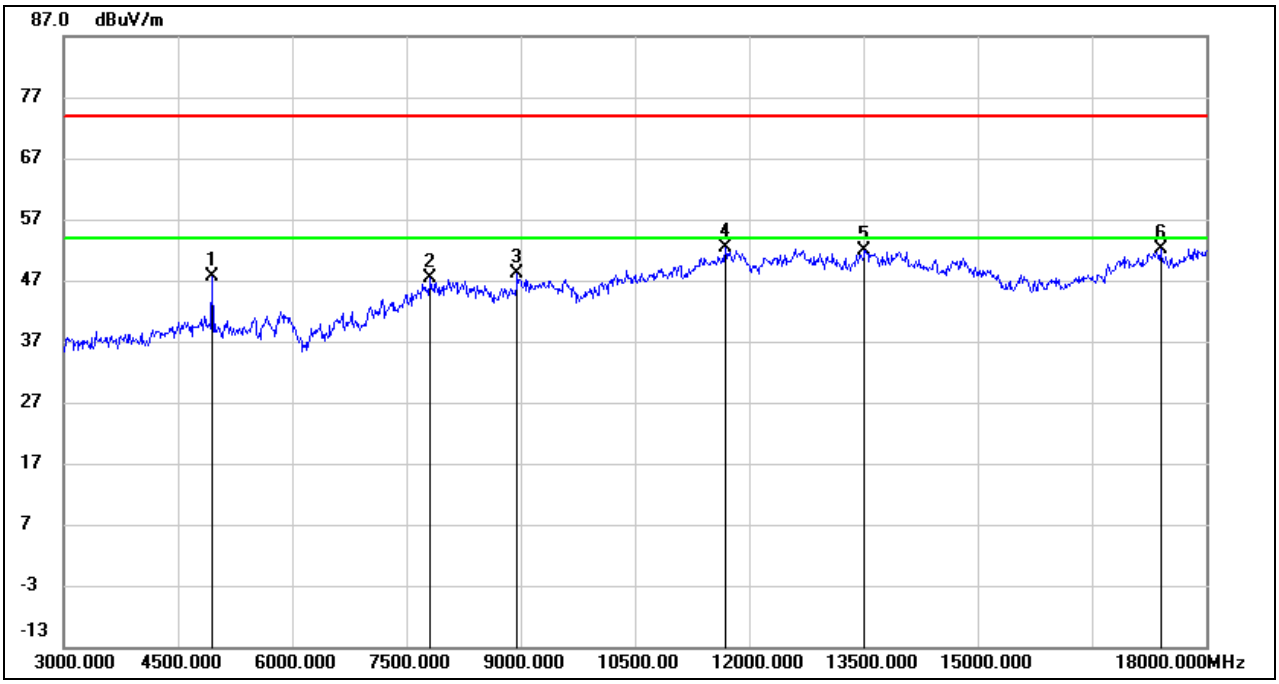
HARMONICS AND SPURIOUS EMISSIONS (MID CHANNEL, VERTICAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4875.000	45.66	0.02	45.68	74.00	-28.32	peak
2	8040.000	38.70	8.64	47.34	74.00	-26.66	peak
3	9435.000	37.22	10.66	47.88	74.00	-26.12	peak
4	11722.500	34.83	17.08	51.91	74.00	-22.09	peak
5	13935.000	32.89	19.32	52.21	74.00	-21.79	peak
6	17992.500	26.99	24.92	51.91	74.00	-22.09	peak

Note: 1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for High Pass Filter losses.
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

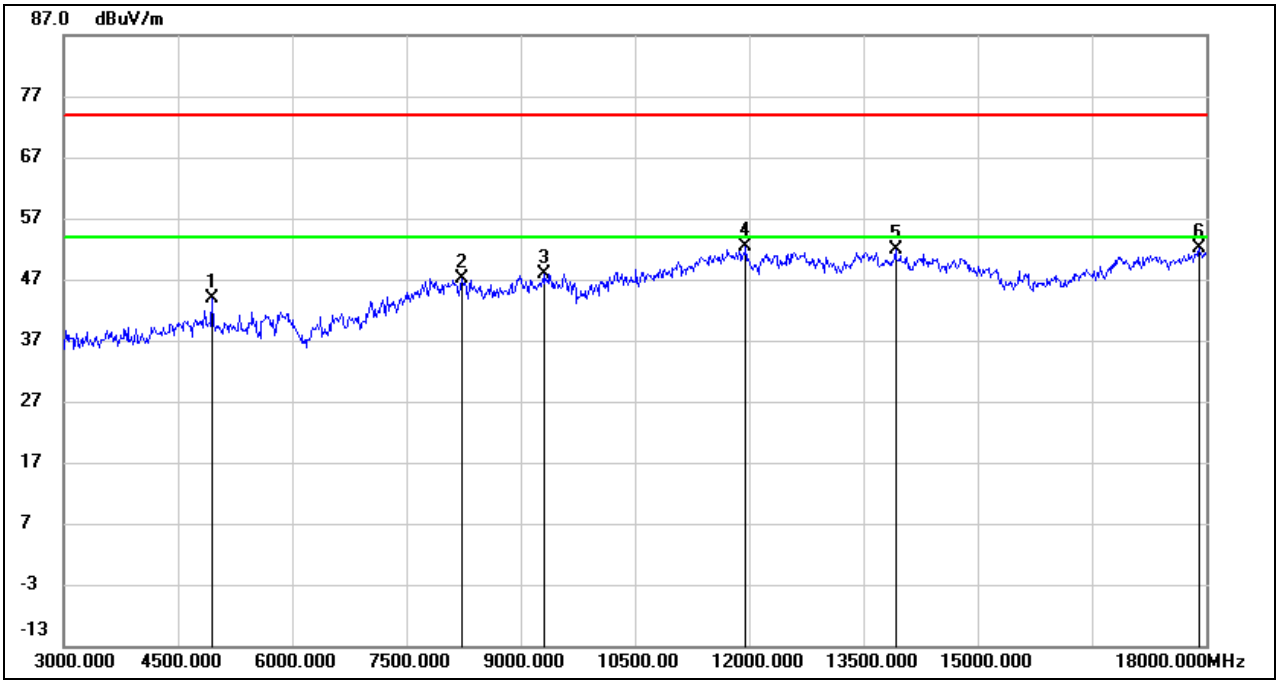
HARMONICS AND SPURIOUS EMISSIONS (HIGH CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4957.500	47.17	0.41	47.58	74.00	-26.42	peak
2	7822.500	38.78	8.60	47.38	74.00	-26.62	peak
3	8955.000	38.22	9.90	48.12	74.00	-25.88	peak
4	11685.000	35.32	17.02	52.34	74.00	-21.66	peak
5	13515.000	32.73	19.18	51.91	74.00	-22.09	peak
6	17407.500	31.23	21.00	52.23	74.00	-21.77	peak

Note: 1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for High Pass Filter losses.
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

HARMONICS AND SPURIOUS EMISSIONS (HIGH CHANNEL, VERTICAL)



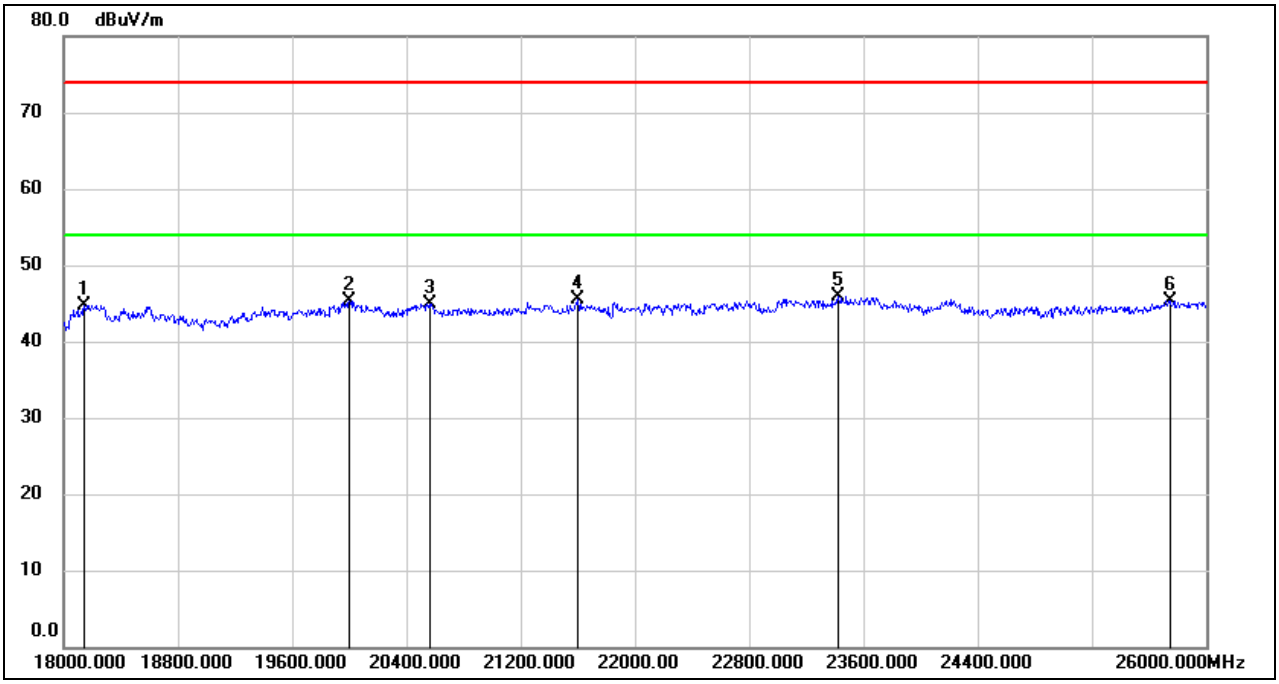
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4957.500	43.36	0.41	43.77	74.00	-30.23	peak
2	8235.000	38.09	9.12	47.21	74.00	-26.79	peak
3	9315.000	37.62	10.23	47.85	74.00	-26.15	peak
4	11955.000	35.25	17.25	52.50	74.00	-21.50	peak
5	13920.000	32.56	19.30	51.86	74.00	-22.14	peak
6	17910.000	27.71	24.38	52.09	74.00	-21.91	peak

Note: 1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for High Pass Filter losses.
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

8.4. SPURIOUS EMISSIONS (18 GHz ~ 26 GHz)

8.4.1. LE 1M MODE

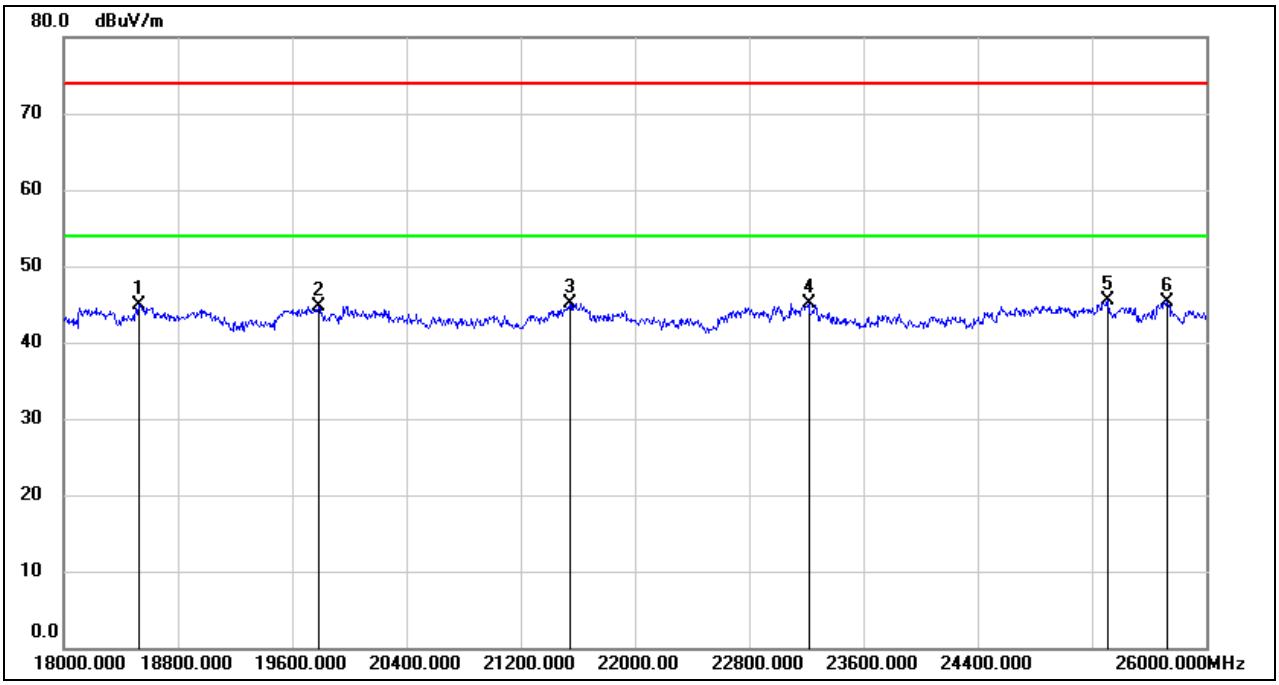
SPURIOUS EMISSIONS (LOW CHANNEL, WORST-CASE CONFIGURATION, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	18144.000	50.27	-5.48	44.79	74.00	-29.21	peak
2	20000.000	50.81	-5.45	45.36	74.00	-28.64	peak
3	20560.000	50.23	-5.30	44.93	74.00	-29.07	peak
4	21600.000	50.02	-4.54	45.48	74.00	-28.52	peak
5	23424.000	49.10	-3.21	45.89	74.00	-28.11	peak
6	25744.000	46.00	-0.64	45.36	74.00	-28.64	peak

Note: 1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.

SPURIOUS EMISSIONS (LOW CHANNEL, WORST-CASE CONFIGURATION, VERTICAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	18528.000	50.11	-5.26	44.85	74.00	-29.15	peak
2	19784.000	50.07	-5.28	44.79	74.00	-29.21	peak
3	21544.000	49.76	-4.63	45.13	74.00	-28.87	peak
4	23216.000	48.51	-3.38	45.13	74.00	-28.87	peak
5	25312.000	47.20	-1.70	45.50	74.00	-28.50	peak
6	25728.000	46.11	-0.72	45.39	74.00	-28.61	peak

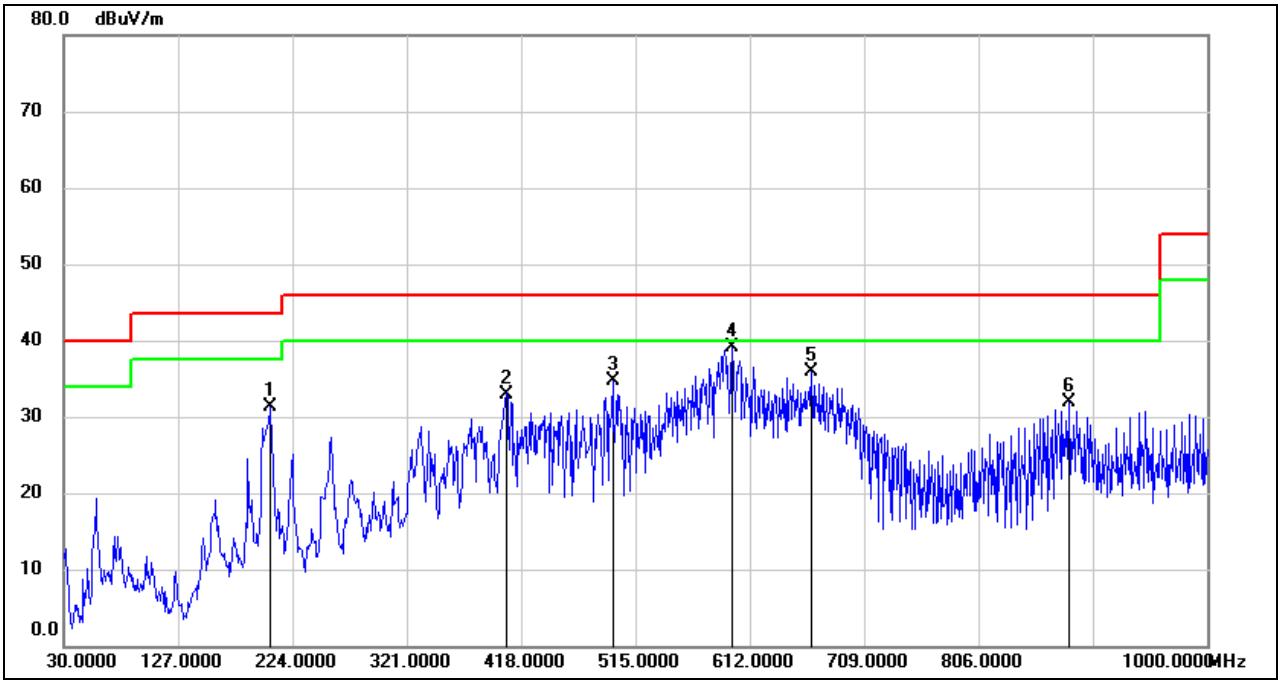
Note: 1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.

Note: All the modes and channels have been tested, but only the worst data was recorded in the report.

8.5. SPURIOUS EMISSIONS (30 MHz ~ 1 GHz)

8.5.1. LE 1M MODE

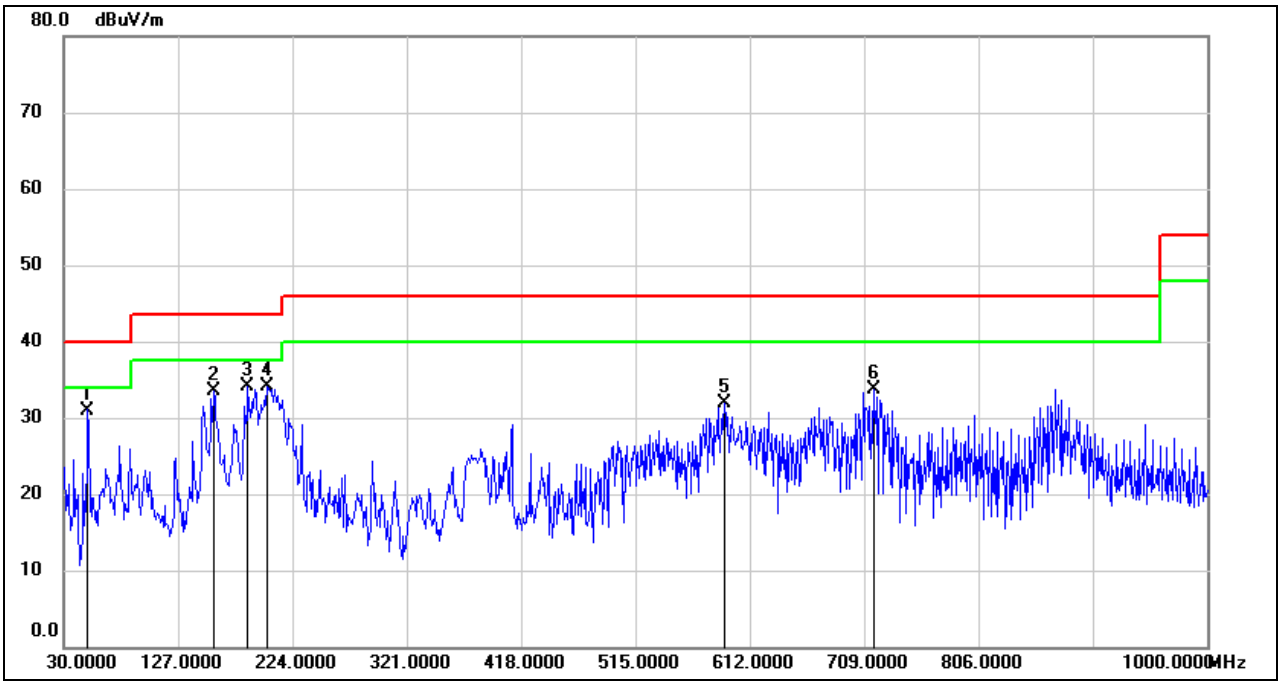
SPURIOUS EMISSIONS (LOW CHANNEL, WORST-CASE CONFIGURATION, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	204.6000	48.08	-16.79	31.29	43.50	-12.21	QP
2	405.3900	46.24	-13.24	33.00	46.00	-13.00	QP
3	495.6000	46.27	-11.57	34.70	46.00	-11.30	QP
4	596.4800	48.79	-9.64	39.15	46.00	-6.85	QP
5	664.3800	44.55	-8.66	35.89	46.00	-10.11	QP
6	882.6300	37.39	-5.45	31.94	46.00	-14.06	QP

Note: 1. Result Level = Read Level + Correct Factor.
2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.
3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.

SPURIOUS EMISSIONS (LOW CHANNEL, WORST-CASE CONFIGURATION, VERTICAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	50.3700	51.76	-20.76	31.00	40.00	-9.00	QP
2	157.0700	51.44	-17.92	33.52	43.50	-9.98	QP
3	186.1700	50.79	-16.72	34.07	43.50	-9.43	QP
4	202.6600	50.66	-16.61	34.05	43.50	-9.45	QP
5	590.6599	41.71	-9.80	31.91	46.00	-14.09	QP
6	716.7600	41.84	-8.14	33.70	46.00	-12.30	QP

Note: 1. Result Level = Read Level + Correct Factor.
2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.
3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto

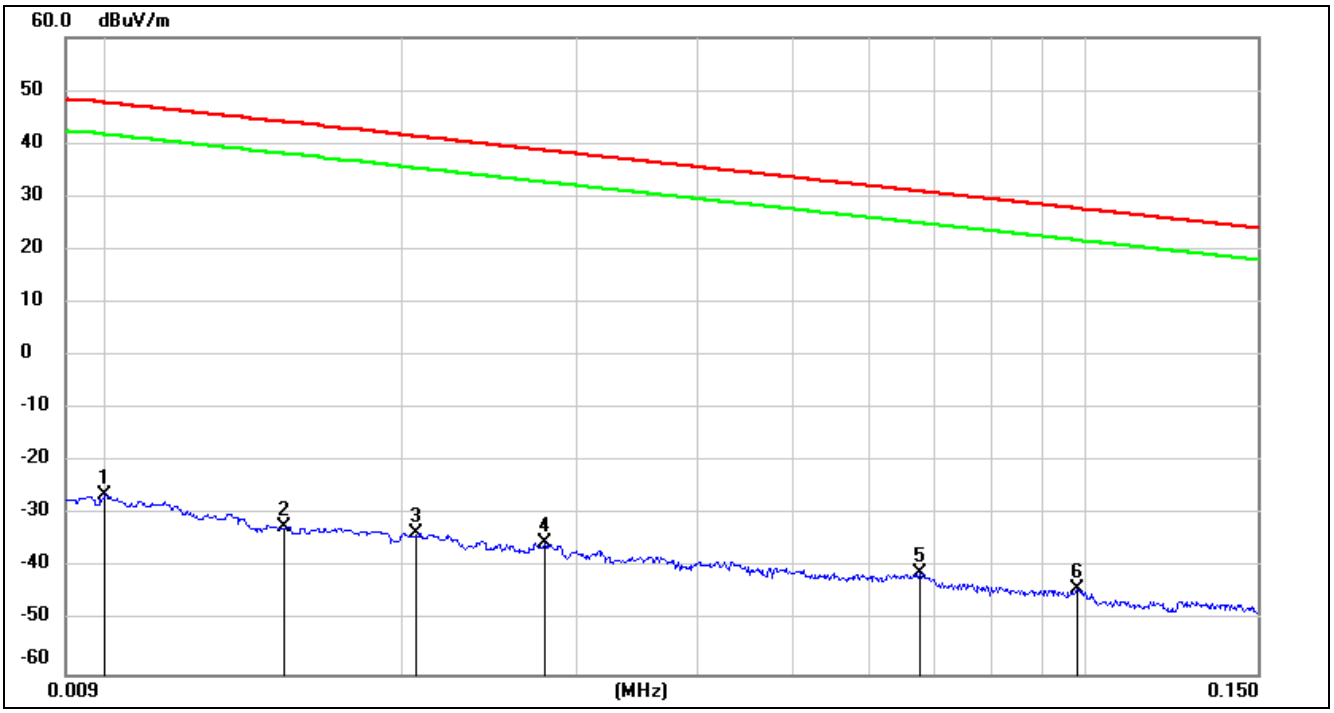
Note: All the modes and channels have been tested, but only the worst data was recorded in the report.

8.6. SPURIOUS EMISSIONS BELOW 30 MHz

8.6.1. LE 1M MODE

SPURIOUS EMISSIONS (LOW CHANNEL, LOOP ANTENNA FACE ON TO THE EUT, WORST-CASE CONFIGURATION)

9 kHz~ 150 kHz



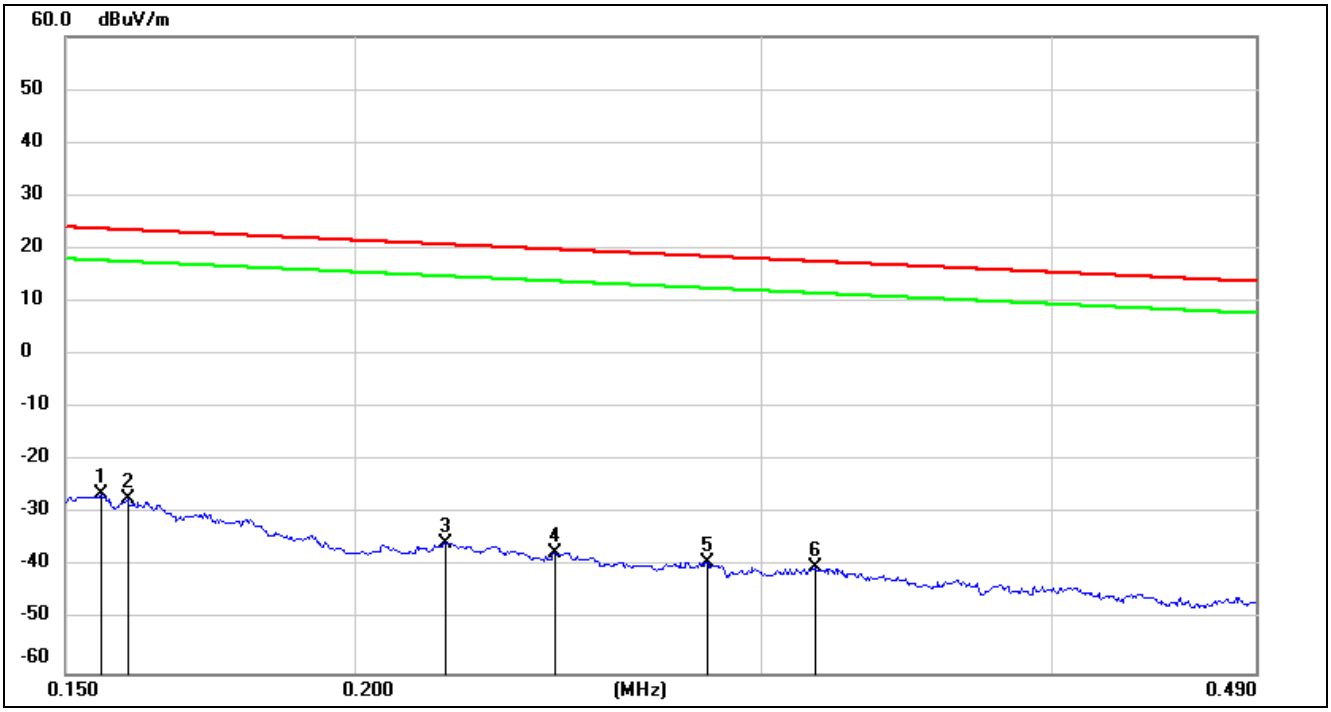
No.	Frequency	Reading	Correct	FCC Result	FCC Limit	ISED Result	ISED Limit	Margin	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dBuA/m)	(dBuA/m)	(dB)	
1	0.0100	75.22	-101.40	-26.18	47.6	-77.68	-3.90	-73.78	peak
2	0.0151	69.21	-101.37	-32.16	44.02	-83.66	-7.48	-76.18	peak
3	0.0206	67.92	-101.35	-33.43	41.32	-84.93	-10.18	-74.75	peak
4	0.0279	66.17	-101.38	-35.21	38.69	-86.71	-12.81	-73.90	peak
5	0.0675	60.64	-101.56	-40.92	31.02	-92.42	-20.48	-71.94	peak
6	0.0981	57.77	-101.78	-44.01	27.77	-95.51	-23.73	-71.78	peak

Note: 1. Measurement = Reading Level + Correct Factor (dBuA/m= dBuV/m- 20Log10[120π] = dBuV/m- 51.5).

2. If Peak Result complies with AV and QP limit, AV and QP Result are deemed to comply with AV limit.

3. All 3 polarizations (Horizontal, Face-on and Face-off) of the loop antenna had been tested, but only the worst data recorded in the report.

150 kHz ~ 490 kHz



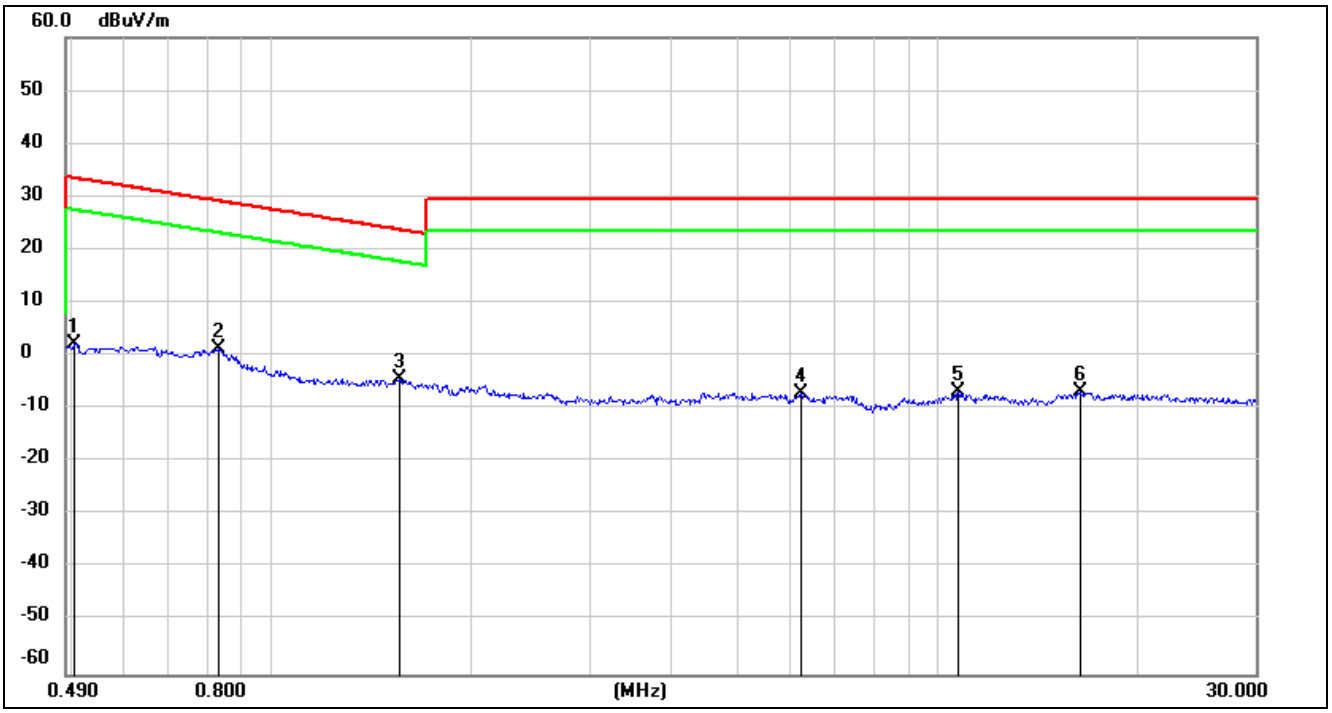
No.	Frequency	Reading	Correct	FCC Result	FCC Limit	ISED Result	ISED Limit	Margin	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dBuA/m)	(dBuA/m)	(dB)	
1	0.1554	75.27	-101.65	-26.38	23.77	-77.88	-27.73	-50.15	peak
2	0.1595	74.36	-101.65	-27.29	23.55	-78.79	-27.95	-50.84	peak
3	0.2190	66.27	-101.75	-35.48	20.79	-86.98	-30.71	-56.27	peak
4	0.2442	64.53	-101.79	-37.26	19.85	-88.76	-31.65	-57.11	peak
5	0.2837	62.72	-101.83	-39.11	18.54	-90.61	-32.96	-57.65	peak
6	0.3163	61.70	-101.87	-40.17	17.6	-91.67	-33.90	-57.77	peak

Note: 1. Measurement = Reading Level + Correct Factor (dBuA/m= dBuV/m- 20Log10[120π] = dBuV/m- 51.5).

2. If Peak Result complies with AV and QP limit, AV and QP Result are deemed to comply with AV limit.

3. All 3 polarizations (Horizontal, Face-on and Face-off) of the loop antenna had been tested, but only the worst data recorded in the report.

490 kHz ~ 30 MHz



No.	Frequency	Reading	Correct	FCC Result	FCC Limit	ISED Result	ISED Limit	Margin	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dBuA/m)	(dBuA/m)	(dB)	
1	0.5039	64.44	-62.07	2.37	33.56	-49.13	-17.94	-31.19	peak
2	0.8296	63.44	-62.17	1.27	29.23	-50.23	-22.27	-27.96	peak
3	1.5564	57.68	-62.02	-4.34	23.76	-55.84	-27.74	-28.10	peak
4	6.2445	54.13	-61.32	-7.19	29.54	-58.69	-21.96	-36.73	peak
5	10.7299	53.98	-60.83	-6.85	29.54	-58.35	-21.96	-36.39	peak
6	16.3959	54.17	-60.96	-6.79	29.54	-58.29	-21.96	-36.33	peak

Note: 1. Measurement = Reading Level + Correct Factor (dBuA/m= dBuV/m- 20Log10[120π] = dBuV/m- 51.5).

2. If Peak Result complies with AV and QP limit, AV and QP Result are deemed to comply with AV limit.

3. All 3 polarizations (Horizontal, Face-on and Face-off) of the loop antenna had been tested, but only the worst data recorded in the report.

9. AC POWER LINE CONDUCTED EMISSIONS

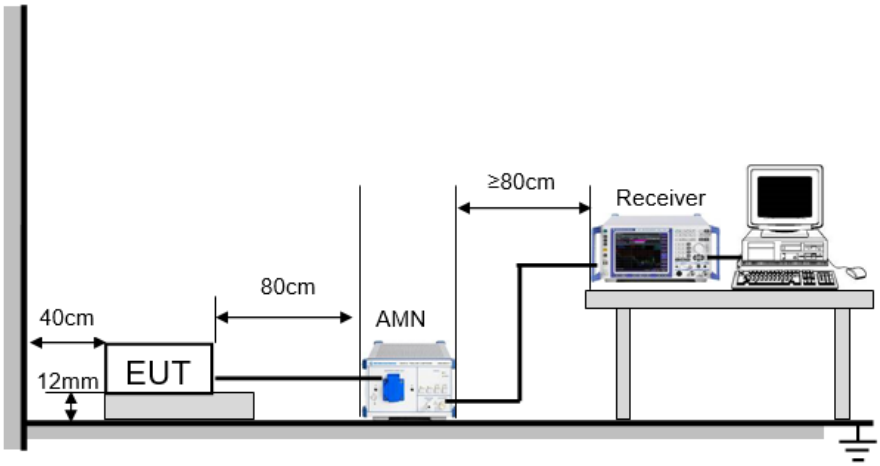
LIMITS

Please refer to CFR 47 FCC §15.207 (a) and ISED RSS-Gen Clause 8.8

FREQUENCY (MHz)	Quasi-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00

TEST SETUP AND PROCEDURE

Refer to ANSI C63.10-2013 clause 6.2.



The EUT is put on a table of non-conducting material that is 12 mm high. The vertical conducting wall of shielding is located 40 cm to the rear of the EUT. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.). A EMI Measurement Receiver (R&S Test Receiver ESR3) is used to test the emissions from both sides of AC line. According to the requirements in Section 6.2 of ANSI C63.10-2013.Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode. The bandwidth of EMI test receiver is set at 9 kHz.

The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application.

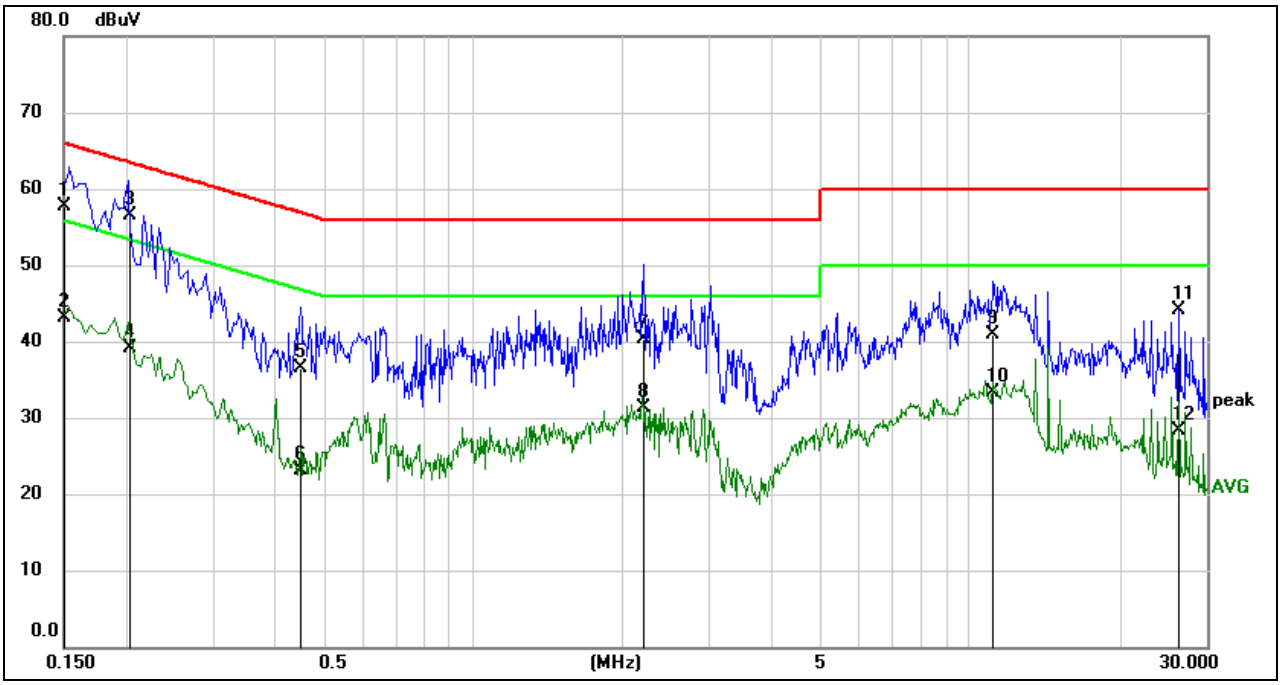
TEST ENVIRONMENT

Temperature	21.7 °C	Relative Humidity	54.3 %
Atmosphere Pressure	101 kPa	Test Voltage	AC 120 V, 60 Hz

RESULTS

9.1. LE 1M MODE

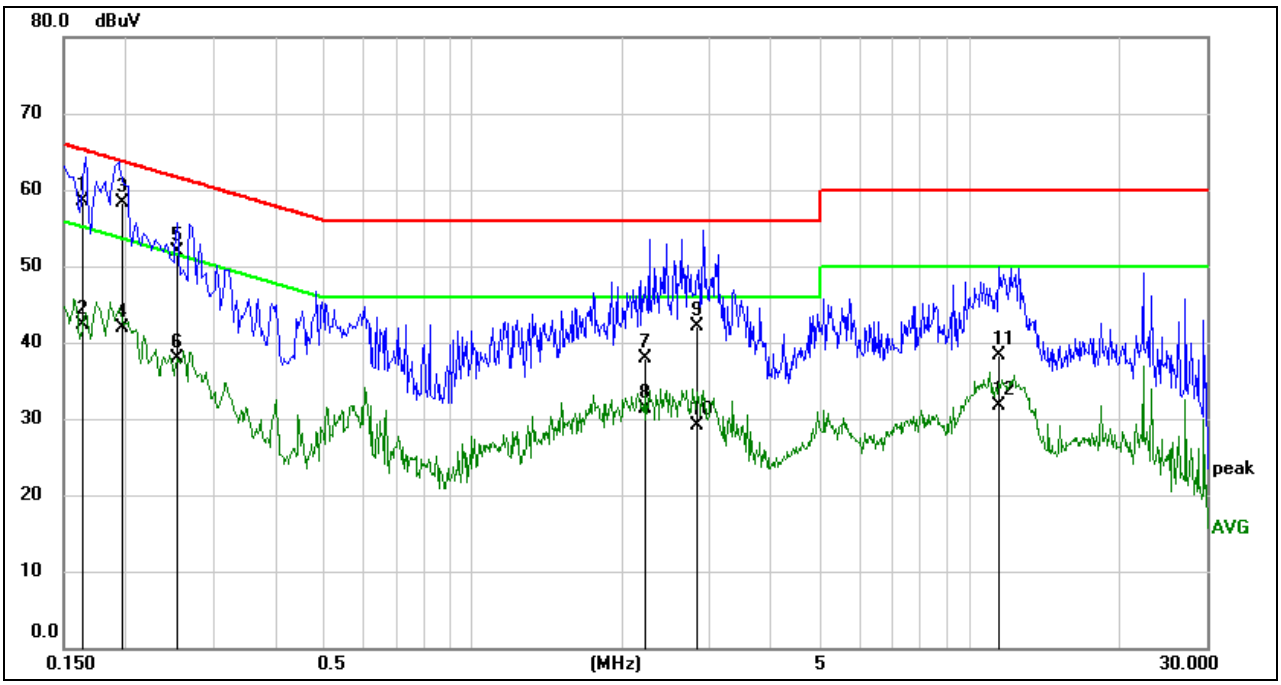
LINE L RESULTS (LOW CHANNEL, WORST-CASE CONFIGURATION)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1504	48.12	9.59	57.71	65.98	-8.27	QP
2	0.1504	33.60	9.59	43.19	55.98	-12.79	AVG
3	0.2048	46.89	9.59	56.48	63.41	-6.93	QP
4	0.2048	29.45	9.59	39.04	53.41	-14.37	AVG
5	0.4514	27.15	9.35	36.50	56.85	-20.35	QP
6	0.4514	13.68	9.35	23.03	46.85	-23.82	AVG
7	2.2041	30.58	9.63	40.21	56.00	-15.79	QP
8	2.2041	21.64	9.63	31.27	46.00	-14.73	AVG
9	11.1805	31.21	9.74	40.95	60.00	-19.05	QP
10	11.1805	23.60	9.74	33.34	50.00	-16.66	AVG
11	26.3840	34.49	9.70	44.19	60.00	-15.81	QP
12	26.3840	18.57	9.70	28.27	50.00	-21.73	AVG

Note: 1. Result = Reading + Correct Factor.
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 200 Hz (9 kHz ~ 150 kHz), 9 kHz (150 kHz ~ 30 MHz).
4. Step size: 80 Hz (0.009 MHz ~ 0.15 MHz), 4 kHz (0.15 MHz ~ 30 MHz), Scan time: auto.

LINE N RESULTS (LOW CHANNEL, WORST-CASE CONFIGURATION)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1629	49.00	9.59	58.59	65.31	-6.72	QP
2	0.1629	32.68	9.59	42.27	55.31	-13.04	AVG
3	0.1977	48.64	9.59	58.23	63.71	-5.48	QP
4	0.1977	32.34	9.59	41.93	53.71	-11.78	AVG
5	0.2537	42.28	9.54	51.82	61.64	-9.82	QP
6	0.2537	28.31	9.54	37.85	51.64	-13.79	AVG
7	2.2298	28.28	9.63	37.91	56.00	-18.09	QP
8	2.2298	21.61	9.63	31.24	46.00	-14.76	AVG
9	2.8358	32.56	9.62	42.18	56.00	-13.82	QP
10	2.8358	19.53	9.62	29.15	46.00	-16.85	AVG
11	11.5205	28.49	9.75	38.24	60.00	-21.76	QP
12	11.5205	21.96	9.75	31.71	50.00	-18.29	AVG

Note: 1. Result = Reading + Correct Factor.
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 200 Hz (9 kHz ~ 150 kHz), 9 kHz (150 kHz ~ 30 MHz).
4. Step size: 80 Hz (0.009 MHz ~ 0.15 MHz), 4 kHz (0.15 MHz ~ 30 MHz), Scan time: auto.

Note: All the modes and channels have been tested, but only the worst data was recorded in the report.

10. ANTENNA REQUIREMENTS

APPLICABLE REQUIREMENTS

Please refer to FCC §15.203
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Please refer to FCC §15.247(b)(4)
The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

RESULTS

Complies

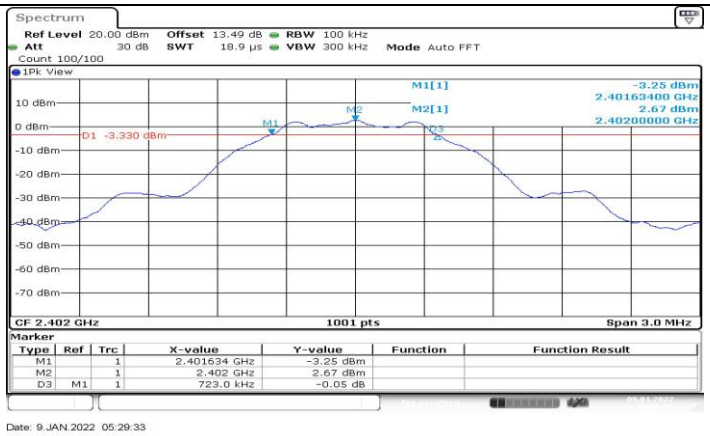
11. Appendix

11.1. Appendix A: DTS Bandwidth

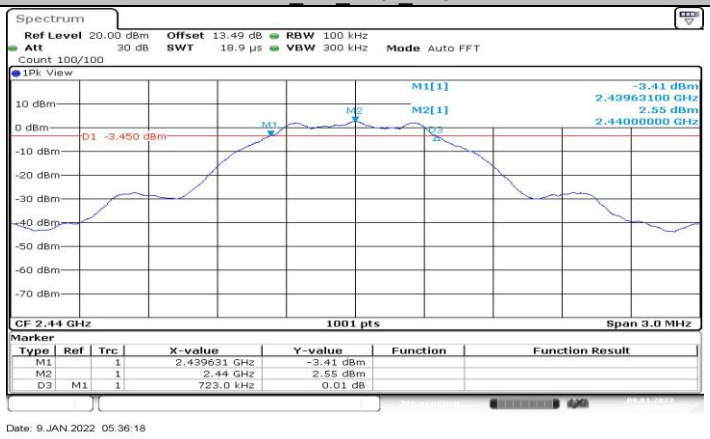
11.1.1. Test Result

Test Mode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.72	2401.63	2402.36	0.5	PASS
		2440	0.72	2439.63	2440.35	0.5	PASS
		2480	0.72	2479.63	2480.35	0.5	PASS

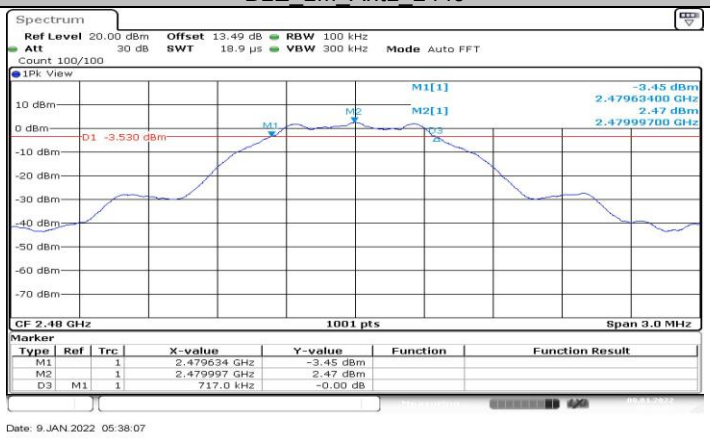
11.1.2. Test Graphs



BLE_1M_Ant1_2402



BLE_1M_Ant1_2440



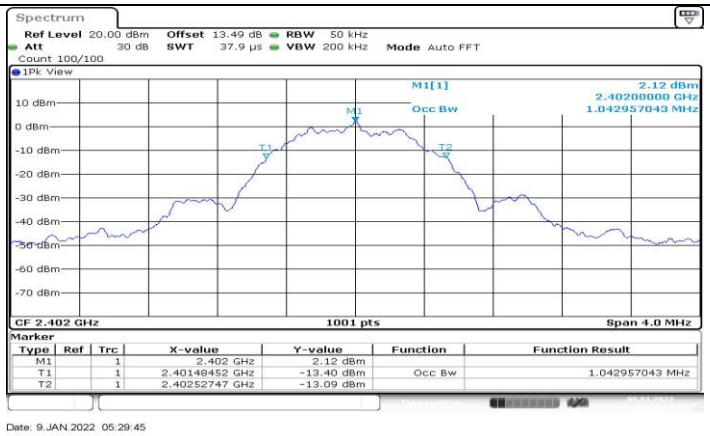
BLE_1M_Ant1_2480

11.2. Appendix B: Occupied Channel Bandwidth

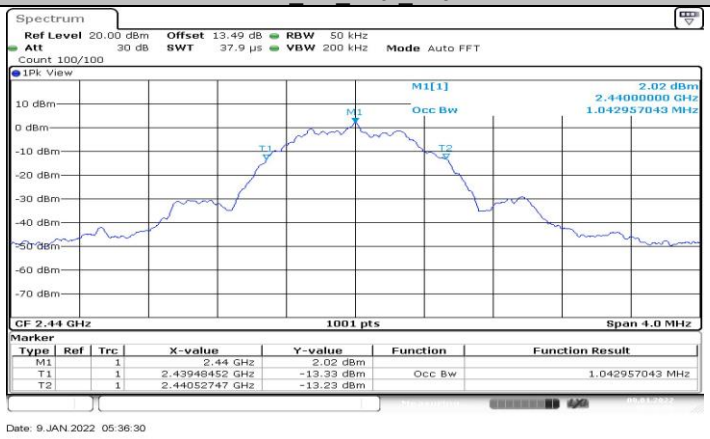
11.2.1. Test Result

Test Mode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Verdict
BLE_1M	Ant1	2402	1.043	2401.485	2402.527	PASS
		2440	1.043	2439.485	2440.527	PASS
		2480	1.039	2479.485	2480.523	PASS

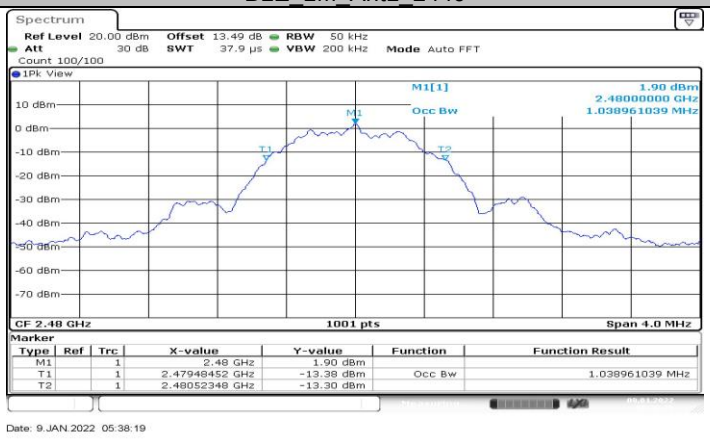
11.2.2. Test Graphs



BLE_1M_Ant1_2402



BLE_1M_Ant1_2440



BLE_1M_Ant1_2480

11.3. Appendix C: Maximum conducted output power

11.3.1. Test Result

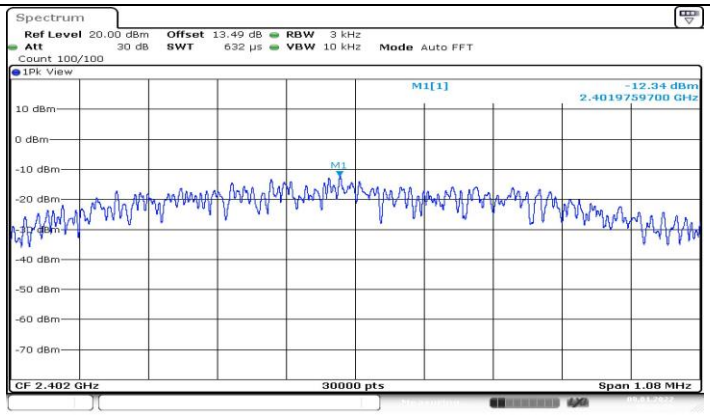
Test Mode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	2.96	≤30	PASS
		2440	2.86	≤30	PASS
		2480	2.76	≤30	PASS

11.4. Appendix D: Maximum power spectral density

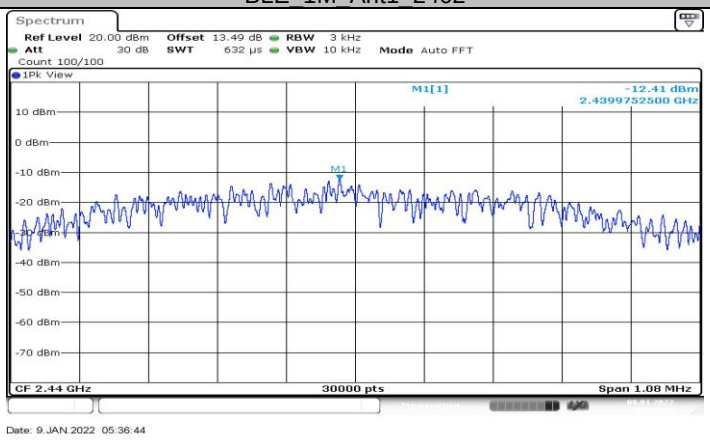
11.4.1. Test Result

Test Mode	Antenna	Channel	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-12.34	≤8.00	PASS
		2440	-12.41	≤8.00	PASS
		2480	-12.49	≤8.00	PASS

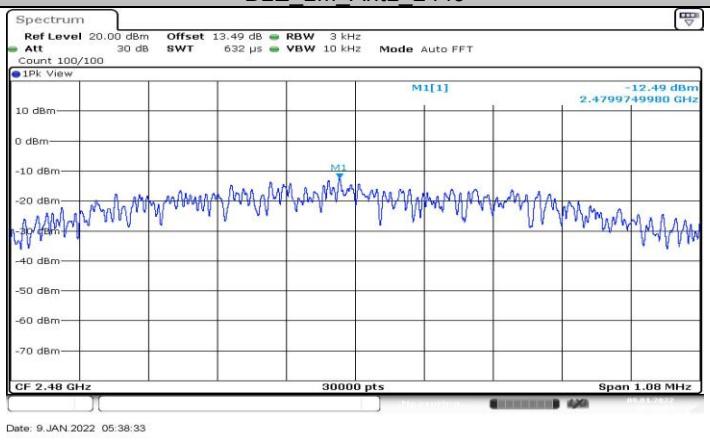
11.4.2. Test Graphs



BLE_1M_Ant1_2402



BLE_1M_Ant1_2440



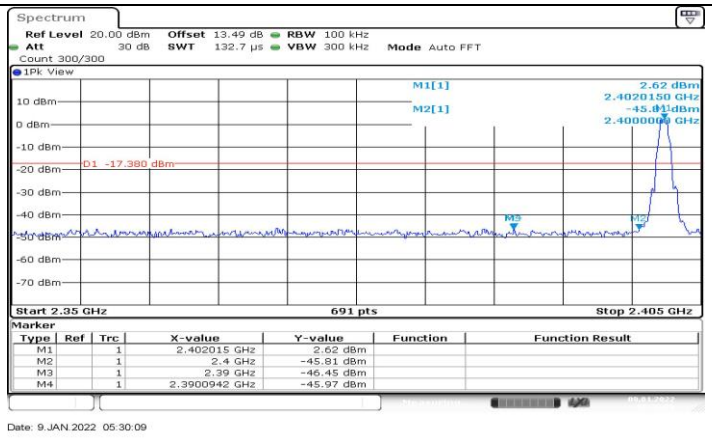
BLE_1M_Ant1_2480

11.5. Appendix E: Band edge measurements

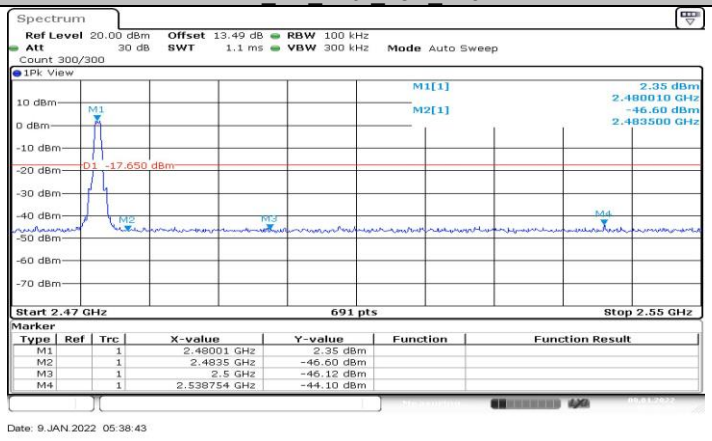
11.5.1. Test Result

Test Mode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	Low	2402	2.62	-45.97	≤-17.38	PASS
		High	2480	2.35	-44.1	≤-17.65	PASS

11.5.2. Test Graphs



BLE_1M_Ant1_Low_2402



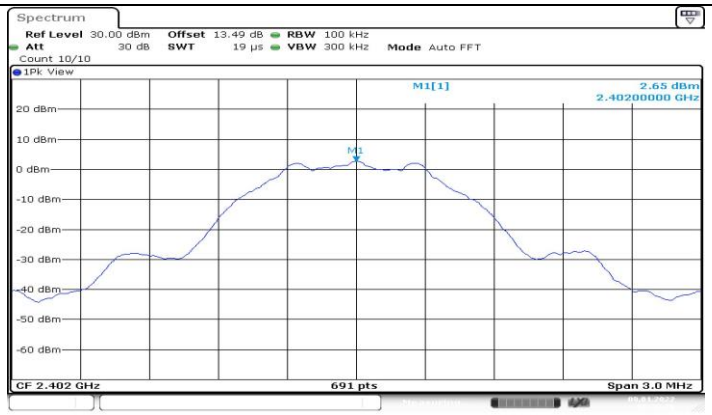
BLE_1M_Ant1_High_2480

11.6. Appendix F: Conducted Spurious Emission

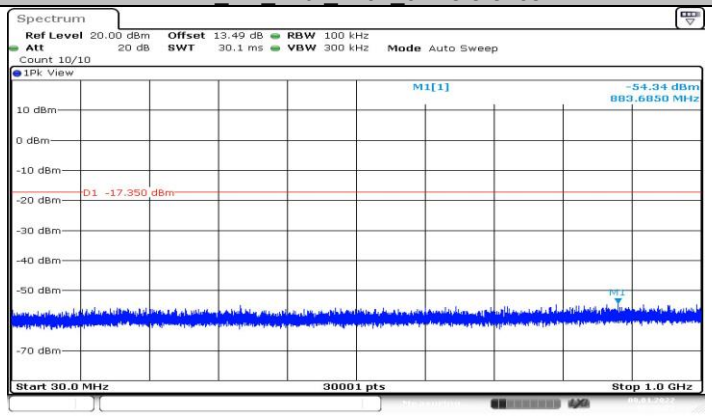
11.6.1. Test Result

Test Mode	Antenna	Channel	FreqRange [MHz]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	Reference	2.65	---	PASS
			30~1000	-54.34	≤-17.35	PASS
			1000~26500	-49.61	≤-17.35	PASS
		2440	Reference	2.55	---	PASS
			30~1000	-54.37	≤-17.45	PASS
			1000~26500	-49.06	≤-17.45	PASS
		2480	Reference	2.44	---	PASS
			30~1000	-54.79	≤-17.56	PASS
			1000~26500	-49.44	≤-17.56	PASS

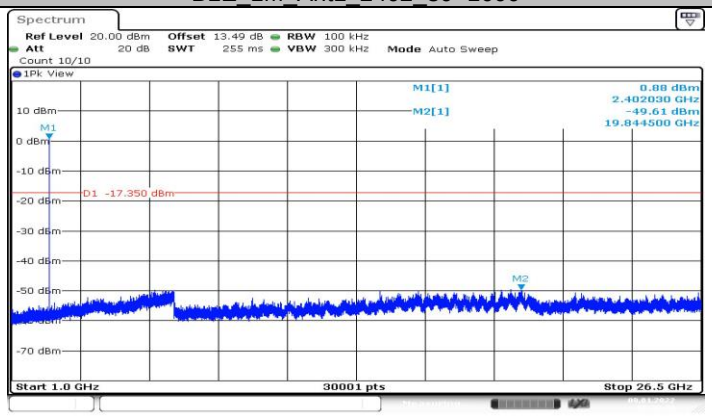
11.6.2. Test Graphs



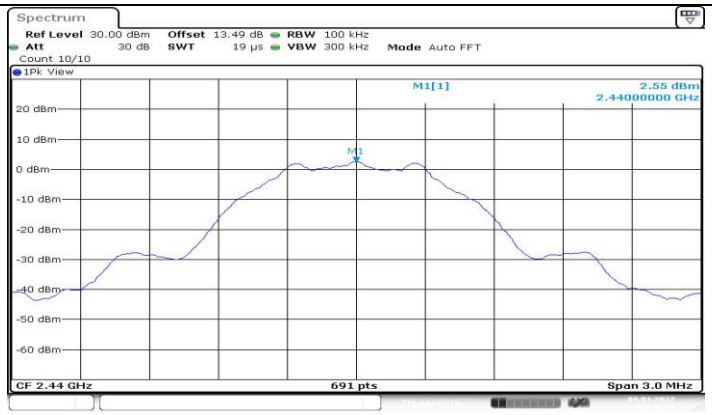
BLE_1M_Ant1_2402_0~Reference



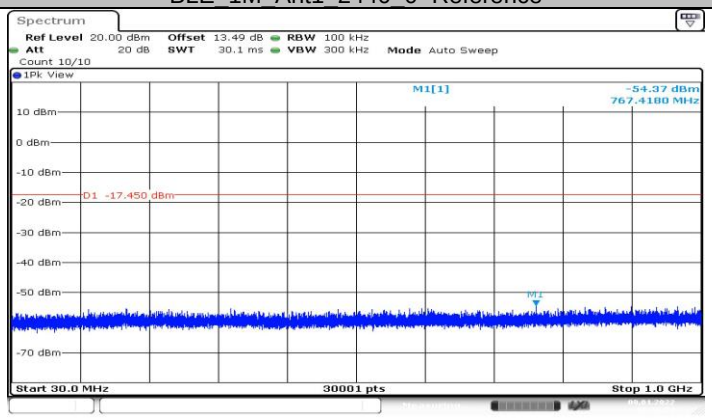
BLE_1M_Ant1_2402_30~1000



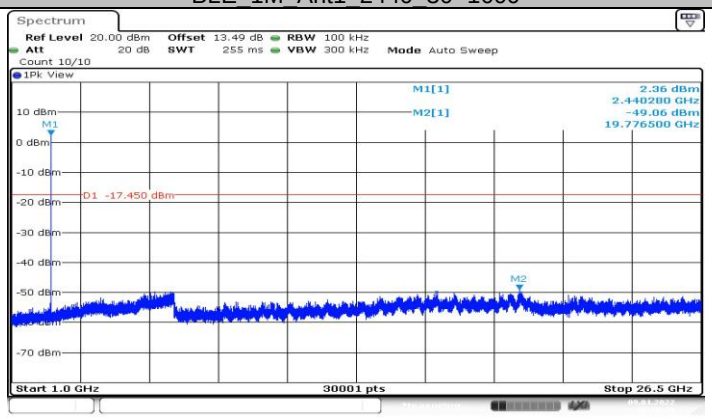
BLE_1M_Ant1_2402_1000~26500



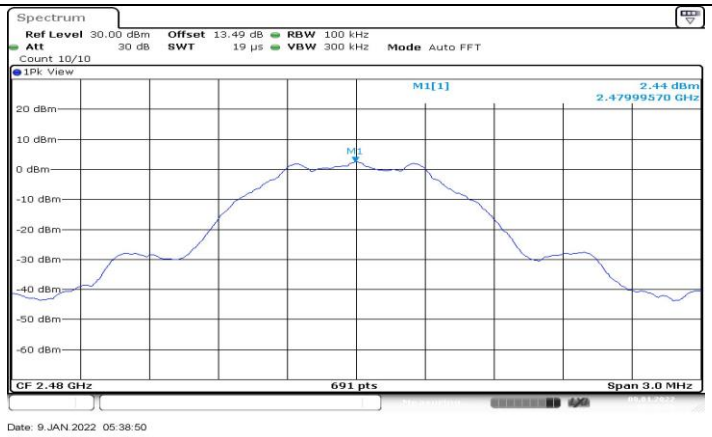
BLE_1M_Ant1_2440_0~Reference



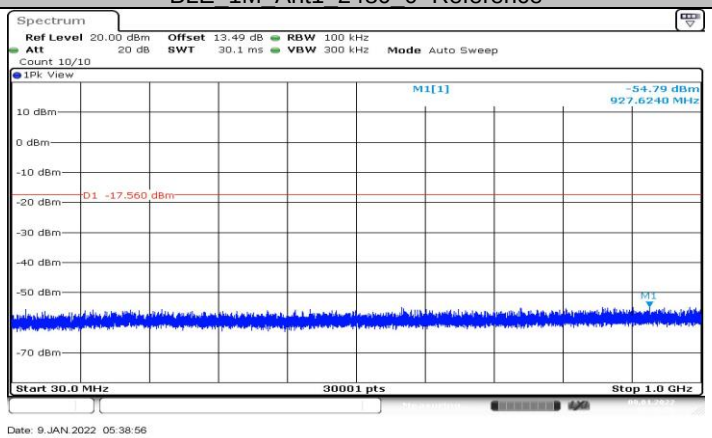
BLE_1M_Ant1_2440_30~1000



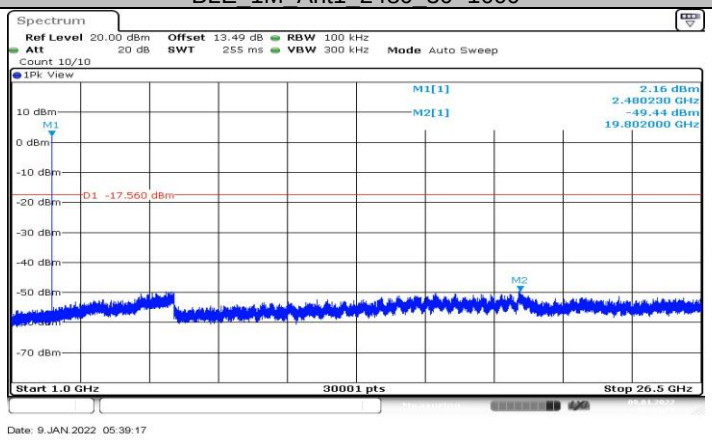
BLE_1M_Ant1_2440_1000~26500



BLE_1M_Ant1_2480_0~Reference



BLE_1M_Ant1_2480_30~1000



BLE_1M_Ant1_2480_1000~26500

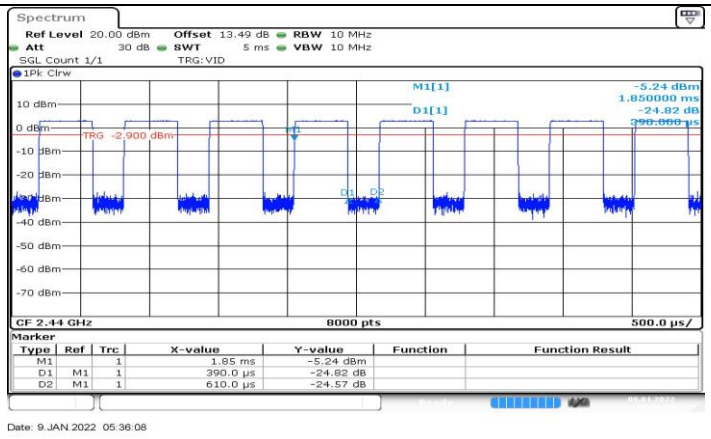
11.7. Appendix G: Duty Cycle

11.7.1. Test Result

Test Mode	On Time (msec)	Period (msec)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/T Minimum VBW (kHz)	Final setting For VBW (kHz)
BLE_1M	0.39	0.61	0.6393	63.93	1.94	2.56	3

Note:
Duty Cycle Correction Factor=10log (1/x).
Where: x is Duty Cycle (Linear)
Where: T is On Time
If that calculated VBW is not available on the analyzer then the next higher value should be used.

11.7.2. Test Graphs



BLE_1M_Ant1_2440

END OF REPORT