



CFR 47 FCC PART 15 SUBPART C

CERTIFICATION TEST REPORT

For

DIMMER

MODEL NUMBER: HDA11FWB

FCC ID: 2AB2QHDA11FWB

REPORT NUMBER: 4789572667-2

ISSUE DATE: August 28, 2020

Prepared for

**LEEDARSON LIGHTING CO.,Ltd.
XINGDA RD, XINGTAI INDUSTRIAL ZONE, CHANGTAI COUNTY, ZHANGZHOU,
FUJIAN, 363900, CHINA**

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, 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	08/28/2020	Initial Issue	



Summary of Test Results			
Clause	Test Items	FCC Rules	Test Results
1	6dB Bandwidth and 99% Occupied Bandwidth	FCC Part 15.247 (a) (2)	Pass
2	Peak Conducted Output Power	FCC Part 15.247 (b) (3)	Pass
3	Power Spectral Density	FCC Part 15.247 (e)	Pass
4	Conducted Bandedge and Spurious Emission	FCC Part 15.247 (d)	Pass
5	Radiated Bandedge and Spurious Emission	FCC Part 15.247 (d) FCC Part 15.209 FCC Part 15.205	Pass
6	Conducted Emission Test For AC Power Port	FCC Part 15.207	Pass
7	Antenna Requirement	FCC Part 15.203	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	6
2. TEST METHODOLOGY	7
3. FACILITIES AND ACCREDITATION	7
4. CALIBRATION AND UNCERTAINTY	8
4.1. MEASURING INSTRUMENT CALIBRATION	8
4.2. MEASUREMENT UNCERTAINTY.....	8
5. EQUIPMENT UNDER TEST	9
5.1. DESCRIPTION OF EUT	9
5.2. MAXIMUM OUTPUT POWER.....	9
5.3. CHANNEL LIST	9
5.4. TEST CHANNEL CONFIGURATION.....	10
5.5. THE WORSE CASE POWER SETTING PARAMETER.....	10
5.6. DESCRIPTION OF AVAILABLE ANTENNAS	10
5.7. WORST-CASE CONFIGURATIONS.....	10
5.8. TEST ENVIRONMENT	10
5.9. DESCRIPTION OF TEST SETUP.....	11
6. MEASURING INSTRUMENT AND SOFTWARE USED	12
7. ANTENNA PORT TEST RESULTS	14
7.1. ON TIME AND DUTY CYCLE.....	14
7.2. 6 dB DTS BANDWIDTH AND 99% BANDWIDTH.....	15
7.3. PEAK CONDUCTED OUTPUT POWER.....	17
7.4. POWER SPECTRAL DENSITY	18
7.5. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS.....	20
8. RADIATED TEST RESULTS.....	22
8.1. RESTRICTED BANDEDGE	28
8.2. SPURIOUS EMISSIONS (1~3GHz)	32
8.3.SPURIOUS EMISSIONS (3~18GHz).....	38
8.4. SPURIOUS EMISSIONS 18G ~ 26GHz.....	44
8.5. SPURIOUS EMISSIONS 30M ~ 1 GHz	46
8.6. SPURIOUS EMISSIONS BELOW 30M.....	48
9. AC POWER LINE CONDUCTED EMISSIONS	51
10. ANTENNA REQUIREMENTS	54



11. Appendix	55
11.1. Appendix A: DUTY CYCLE	55
11.1.1. Test Result	55
11.1.1. Test Graphs	56
11.2. Appendix B: DTS Bandwidth	57
11.2.1. Test Result	57
11.2.2. Test Graphs	58
11.3. Appendix C: Occupied Channel Bandwidth	60
11.3.1. Test Result	60
11.3.2. Test Graphs	61
11.4. Appendix D: Maximum conducted output power	63
11.4.1. Test Result	63
11.5. Appendix E: Maximum power spectral density	64
11.5.1. Test Result	64
11.5.2. Test Graphs	65
11.6. Appendix F: Band edge measurements	67
11.6.1. Test Result	67
11.6.2. Test Graphs	68
11.7. Appendix G: Conducted Spurious Emission	69
11.7.1. Test Result	69
11.7.2. Test Graphs	70



1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name: LEEDARSON LIGHTING CO.,Ltd.
Address: XINGDA RD, XINGTAI INDUSTRIAL ZONE, CHANGTAI COUNTY,
ZHANGZHOU, FUJIAN, 363900, CHINA

Manufacturer Information

Company Name: LEEDARSON LIGHTING CO.,Ltd.
Address: XINGDA RD, XINGTAI INDUSTRIAL ZONE, CHANGTAI COUNTY,
ZHANGZHOU, FUJIAN, 363900, CHINA

EUT Information

EUT Name: DIMMER
Model: HDA11FWB
Sample Status: Normal
Sample ID: 3220784
Sample Received Date: July 29, 2020
Date of Tested: July 29, 2020~ August 7, 2020

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 FCC PART 15 SUBPART C	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.

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 Declaration 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. 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 30MHz, lab had performed measurements at test anechoic chamber and comparing to measurements obtained on an open field site. And these measurements below 30MHz 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	3.62dB
Radiation Emission test(include Fundamental emission) (9kHz-30MHz)	2.2dB
Radiation Emission test(include Fundamental emission) (30MHz-1GHz)	4.00dB
Radiation Emission test (1GHz to 26GHz)(include Fundamental emission)	5.78dB (1GHz-18GHz)
	5.23dB (18GHz-26GHz)
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	DIMMER	
Model	HDA11FWB	
Product Description	Operation Frequency	2402 MHz ~ 2480 MHz
	Modulation Type	Data Rate
	GFSK	1Mbps
Rated Input	AC120 V,60 Hz	

5.2. MAXIMUM OUTPUT POWER

Bluetooth Mode	Frequency (MHz)	Channel Number	Max Output Power (dBm)	EIRP (dBm)
BLE	2402-2480	0-39[40]	9.562	7.862

5.3. 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	/	/

**5.4. TEST CHANNEL CONFIGURATION**

Test Mode	Test Channel	Frequency
BLE_1M	CH0, CH19, CH39 Low, Middle, High	2402MHz, 2440MHz, 2480MHz

5.5. THE WORSE CASE POWER SETTING PARAMETER

The Worse Case Power Setting Parameter under 2400 ~ 2483.5MHz Band				
Test Software		ESP_RF_test_tool_v1.1.0		
Modulation Type	Transmit Antenna Number	Test Software setting value		
		CH 0	CH 19	CH 39
GFSK(1Mbps)	1	8	8	8

5.6. DESCRIPTION OF AVAILABLE ANTENNAS

Antenna	Frequency (MHz)	Antenna Type	MAX Antenna Gain (dBi)
1	2402-2480	PCB antenna	-1.7

Test Mode	Transmit and Receive Mode	Description
BLE_1M	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

Bluetooth Mode	Modulation Technology	Modulation Type	Data Rate (Mbps)
BLE	DTS	GFSK	1Mbit/s

5.8. TEST ENVIRONMENT

Environment Parameter	Selected Values During Tests	
Relative Humidity	45 ~ 70%	
Atmospheric Pressure:	1025Pa	
Temperature	TN	22 ~ 28°C
Voltage :	VL	N/A
	VN	AC 120V,60Hz
	VH	N/A

Note: VL= Lower Extreme Test Voltage

VN= Nominal Voltage

VH= Upper Extreme Test Voltage

TN= Normal Temperature

5.9. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	Remarks
1	Laptop	ThinkPad	X230i	/
2	USB TO UART	/	/	/
3	LED Lamp	/	/	100W

I/O CABLES

Item	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
1	USB	NA	NA	1	/

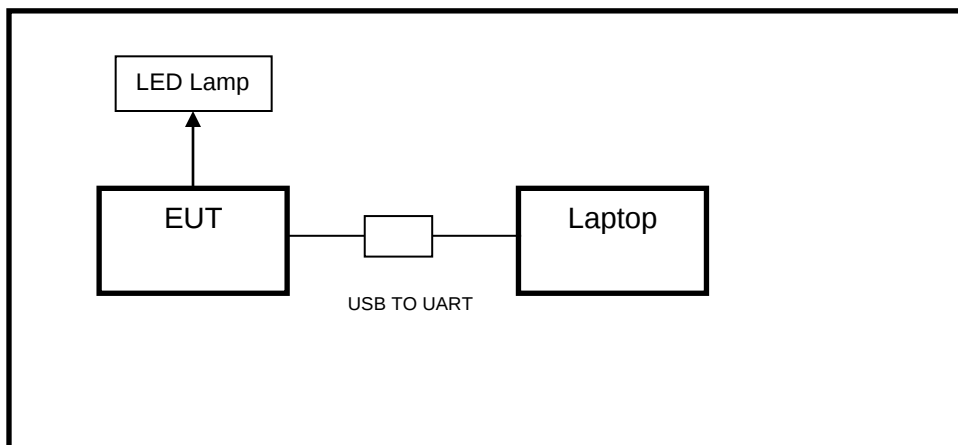
ACCESSORY

Item	Accessory	Brand Name	Model Name	Description
/	/	/	/	/

TEST SETUP

The EUT can work in engineering mode with a software through a Laptop.

SETUP DIAGRAM FOR TEST





6. MEASURING INSTRUMENT AND SOFTWARE USED

Conducted Emissions						
Instrument						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
☒	EMI Test Receiver	R&S	ESR3	101961	Dec.05,2019	Dec.05,2020
☒	Two-Line V-Network	R&S	ENV216	101983	Dec.05,2019	Dec.05,2020
☒	Artificial Mains Networks	Schwarzbeck	NSLK 8126	8126465	Dec.05,2019	Dec.05,2020
Software						
Used	Description		Manufacturer	Name		Version
☒	Test Software for Conducted disturbance		Farad	EZ-EMC		Ver. UL-3A1
Radiated Emissions						
Instrument						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
☒	MXE EMI Receiver	KESIGHT	N9038A	MY56400036	Dec.06,2019	Dec.06,2020
☒	Hybrid Log Periodic Antenna	TDK	HLP-3003C	130960	Sep.17, 2018	Sep.17, 2021
☒	Preamplifier	HP	8447D	2944A09099	Dec.05,2019	Dec.05,2020
☒	EMI Measurement Receiver	R&S	ESR26	101377	Dec.05,2019	Dec.05,2020
☒	Horn Antenna	TDK	HRN-0118	130939	Sep.17, 2018	Sep.17, 2021
☒	High Gain Horn Antenna	Schwarzbeck	BBHA-9170	691	Aug.11, 2018	Aug.11, 2021
☒	Preamplifier	TDK	PA-02-0118	TRS-305-00066	Dec.05,2019	Dec.05,2020
☒	Preamplifier	TDK	PA-02-2	TRS-307-00003	Dec.05,2019	Dec.05,2020
☒	Loop antenna	Schwarzbeck	1519B	00008	Jan.07, 2019	Jan.07, 2022
☒	Band Reject Filter	Wainwright	WRCJV8-2350-2400-2483.5-2533.5-40SS	4	Dec.05,2019	Dec.05,2020
☒	High Pass Filter	Wi	WHKX10-2700-3000-18000-40SS	23	Dec.05,2019	Dec.05,2020
Software						
Used	Description		Manufacturer	Name		Version
☒	Test Software for Radiated disturbance		Farad	EZ-EMC		Ver. UL-3A1
Other instruments						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.



☒	Spectrum Analyzer	Keysight	N9030A	MY55410512	Dec.06,2019	Dec.06,2020
☒	Power Meter	Keysight	N1911A	MY55416024	Dec.06,2019	Dec.06,2020
☒	Power Sensor	Keysight	U2021XA	MY5100022	Dec.06,2019	Dec.06,2020



7. ANTENNA PORT TEST RESULTS

7.1. ON TIME AND DUTY CYCLE

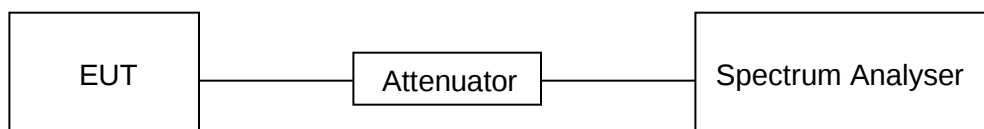
LIMITS

None; for reporting purposes only

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method

TEST SETUP



TEST ENVIRONMENT

Temperature	24.9 °C	Relative Humidity	61.4 %
Atmosphere Pressure	101 kPa	Test Voltage	AC 120 V,60 Hz

RESULTS

Please refer to appendix A.



7.2. 6 dB DTS BANDWIDTH AND 99% 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)	6dB Bandwidth	$\geq 500\text{KHz}$	2400-2483.5
ISED RSS-Gen Clause 6.7	99% Occupied Bandwidth	For reporting purposes only.	2400-2483.5

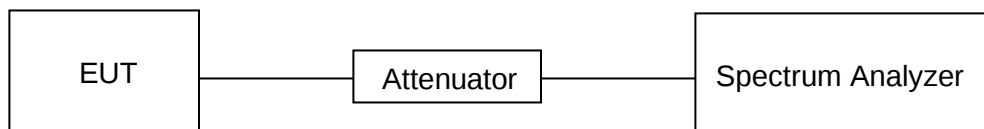
TEST PROCEDURE

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

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	For 6 dB Bandwidth :100kHz For 99% Occupied Bandwidth :1% to 5% of the occupied bandwidth
VBW	For 6dB Bandwidth : $\geq 3 \times \text{RBW}$ For 99% Occupied Bandwidth : $\geq 3 \times \text{RBW}$
Trace	Max hold
Sweep	Auto couple

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/99% relative to the maximum level measured in the fundamental emission.

TEST SETUP





TEST ENVIRONMENT

Temperature	24.9 °C	Relative Humidity	61.4 %
Atmosphere Pressure	101 kPa	Test Voltage	AC 120 V,60 Hz

RESULTS

Please refer to appendix B and C.



7.3. PEAK CONDUCTED OUTPUT POWER

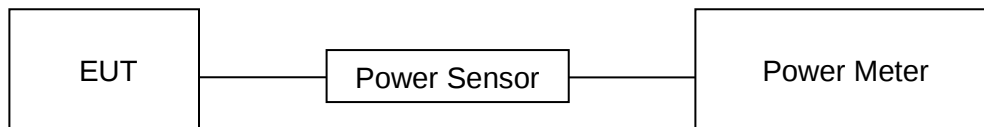
LIMITS

CFR 47 FCC Part15 (15.247) Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
CFR 47 FCC 15.247(b)(3)	Peak Output Power	1 watt or 30dBm	2400-2483.5

TEST PROCEDURE

Place the EUT on the table and set it in the transmitting mode.
Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Power sensor.
Measure peak power each channel.

TEST SETUP



TEST ENVIRONMENT

Temperature	24.9 °C	Relative Humidity	61.4 %
Atmosphere Pressure	101 kPa	Test Voltage	AC 120 V,60 Hz

RESULTS

Please refer to appendix D.



7.4. POWER SPECTRAL DENSITY

LIMITS

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

TEST PROCEDURE

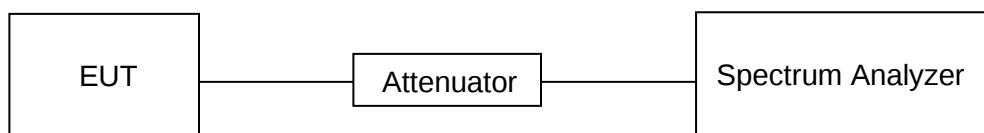
Connect the UUT to the spectrum analyser and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	$3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$
VBW	$\geq 3 \times \text{RBW}$
Span	$1.5 \times \text{DTS bandwidth}$
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	24.9 °C	Relative Humidity	61.4 %
Atmosphere Pressure	101 kPa	Test Voltage	AC 120 V,60 Hz

RESULTS

Please refer to appendix E.



7.5. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

LIMITS

CFR 47 FCC Part15 (15.247) Subpart C		
Section	Test Item	Limit
CFR 47 FCC §15.247 (d)	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

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

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	100kHz
VBW	$\geq 3 \times \text{RBW}$
Span	$\geq 1.5 \times \text{DTS bandwidth}$
Trace	Max hold
Sweep time	Auto couple

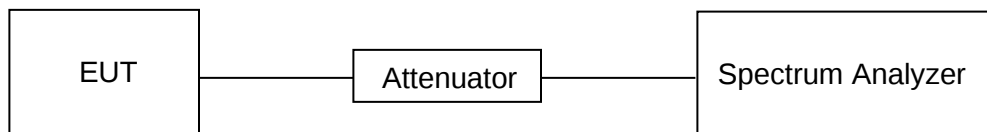
Use the peak marker function to determine the maximum PSD level.

Span	Set the center frequency and span to encompass frequency range to be measured
Detector	Peak
RBW	100kHz
VBW	$\geq 3 \times \text{RBW}$
measurement points	$\geq \text{span}/\text{RBW}$
Trace	Max hold
Sweep time	Auto couple

Use the peak marker function to determine the maximum amplitude level.



TEST SETUP



TEST ENVIRONMENT

Temperature	24.9 °C	Relative Humidity	61.4 %
Atmosphere Pressure	101 kPa	Test Voltage	AC 120 V,60 Hz

RESULTS

Please refer to appendix F and G.



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)(9kHz-1GHz)

Emissions radiated outside of the specified frequency bands above 30MHz			
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 30MHz		
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

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):

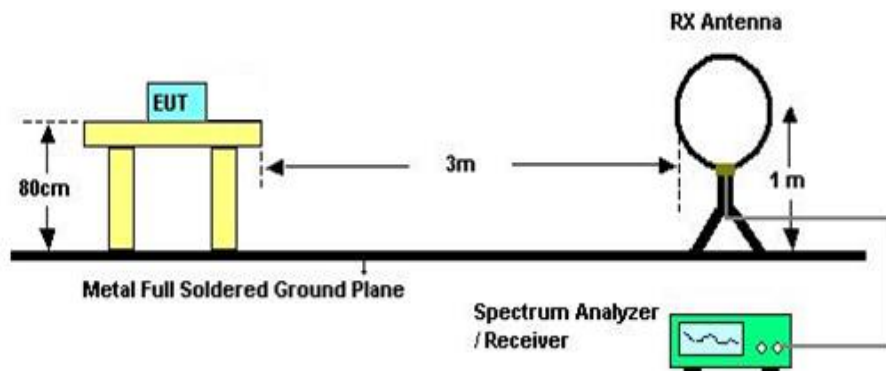
MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
¹ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	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: ¹Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

²Above 38.6c

TEST SETUP AND PROCEDURE

Below 30MHz

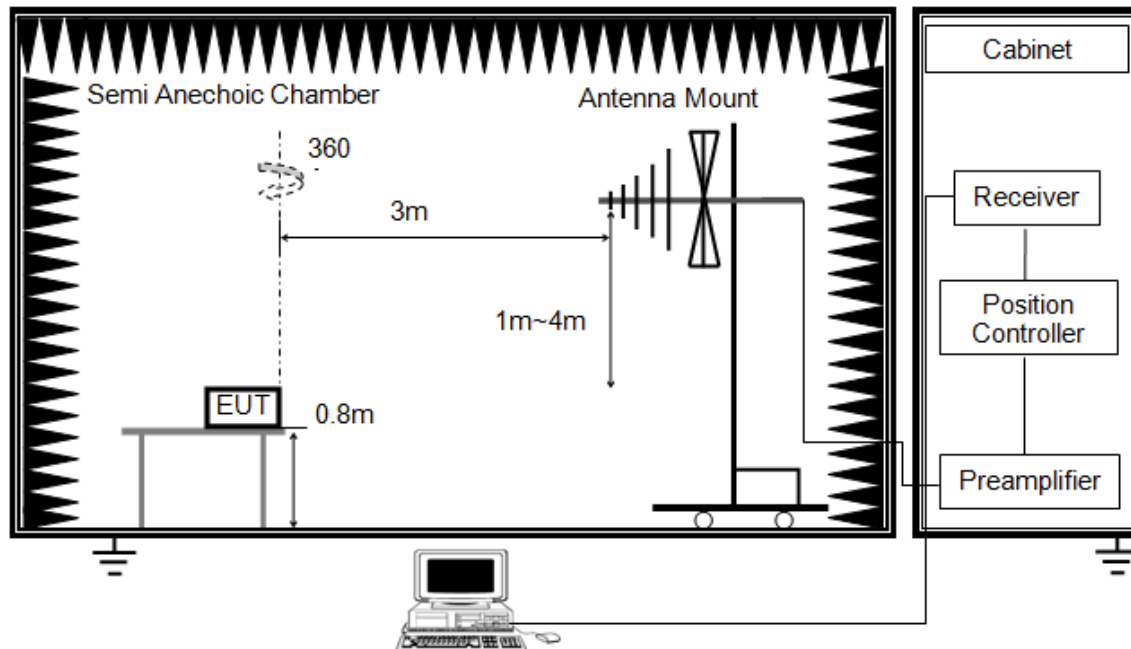


The setting of the spectrum analyser

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

1. The testing follows the guidelines in ANSI C63.10-2013
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 80cm above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of 1 meter 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 1GHz, 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.

Below 1G and above 30MHz

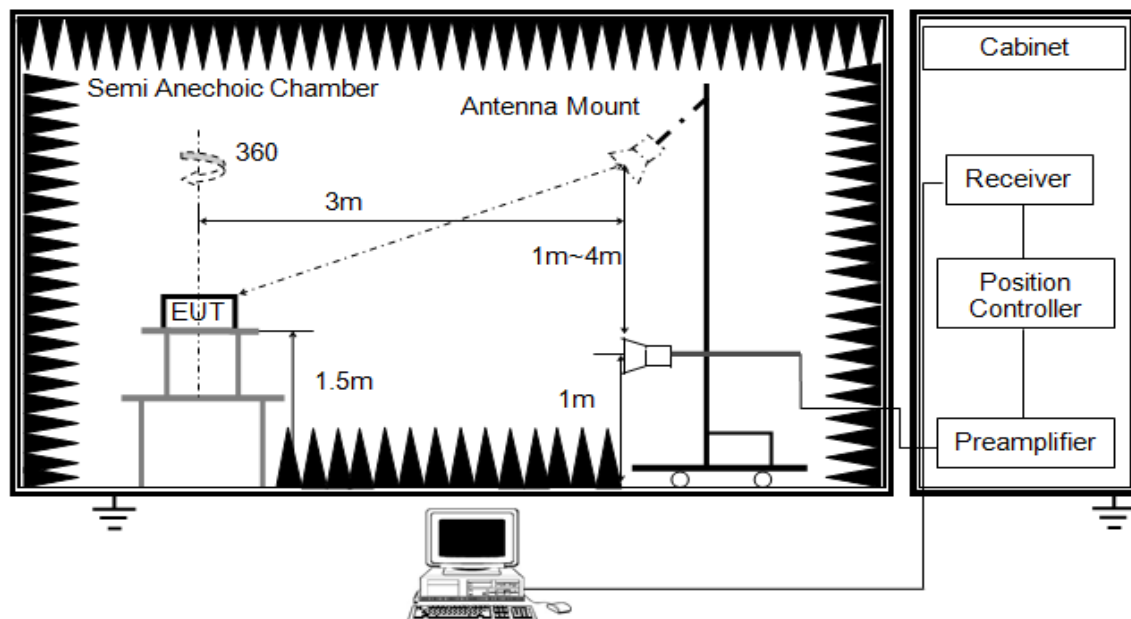


The setting of the spectrum analyser

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

1. The testing follows the guidelines in ANSI C63.10-2013.
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 80cm 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 1GHz, 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 1G

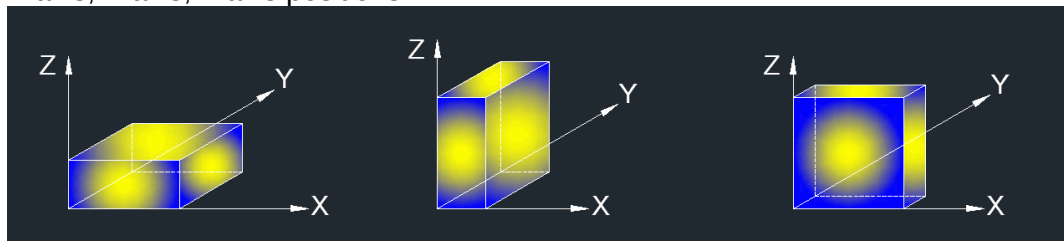


The setting of the spectrum analyser

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

1. The testing follows the guidelines in ANSI C63.10-2013.
2. The EUT was arranged to its worst case and then tune the antenna tower (1.5 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 1.5m 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 1GHz, 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.

TEST ENVIRONMENT

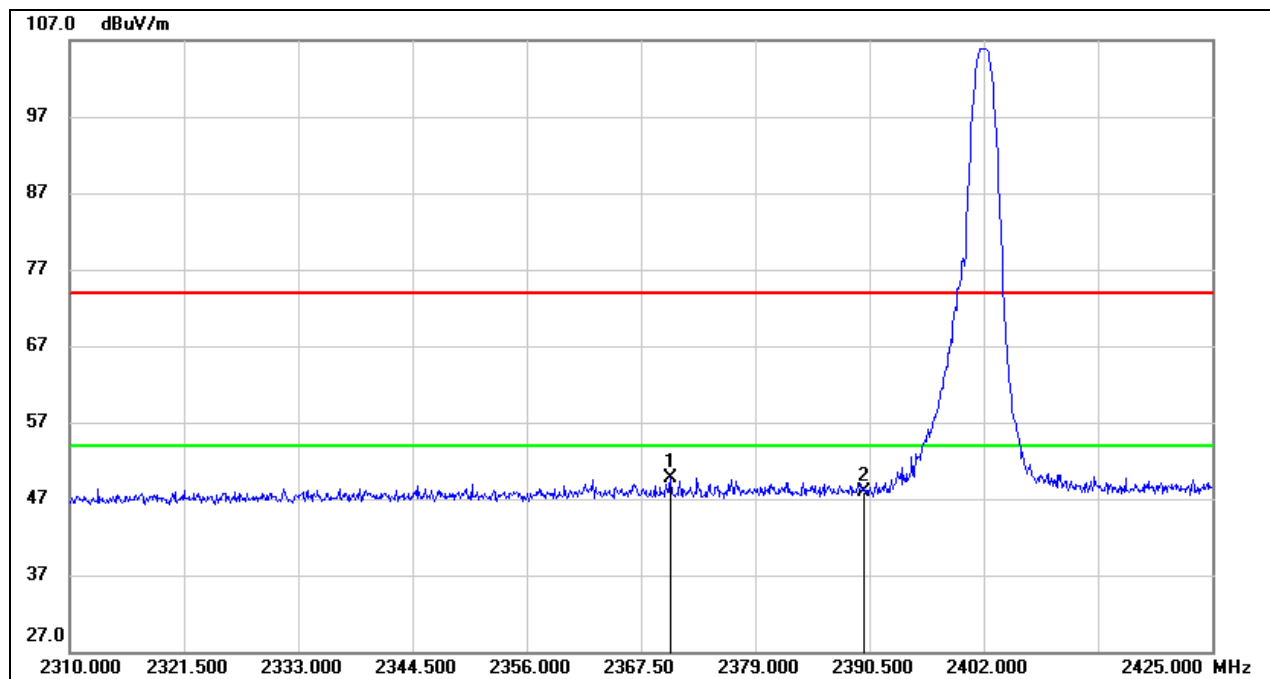
Temperature	24.9 °C	Relative Humidity	61.4 %
Atmosphere Pressure	101 kPa	Test Voltage	AC 120 V,60 Hz

RESULTS



8.1. RESTRICTED BANDEDGE

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

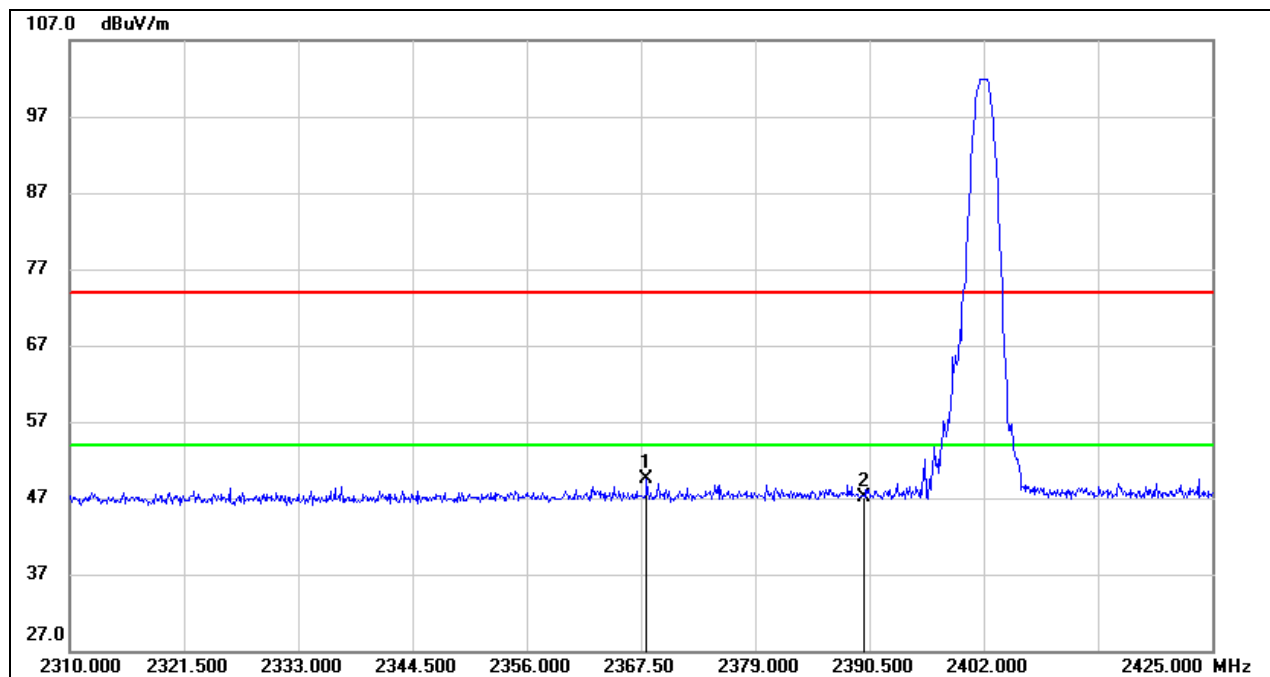


No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2370.490	16.79	32.88	49.67	74.00	-24.33	peak
2	2390.000	14.92	32.94	47.86	74.00	-26.14	peak

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 case emission will be recorder, if it complies with the limit, the other emissions deemed to comply with the limit.



RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



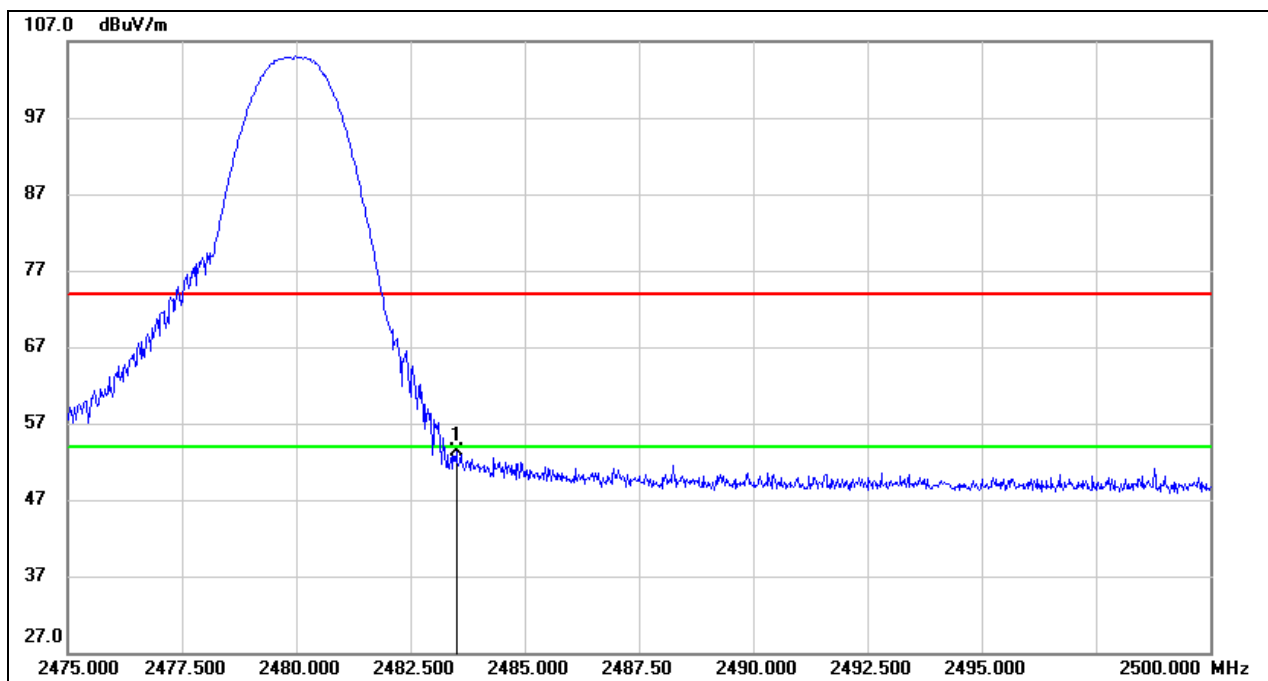
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2368.075	16.55	32.87	49.42	74.00	-24.58	peak
2	2390.000	14.22	32.94	47.16	74.00	-26.84	peak

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 case emission will be recorder, if it complies with the limit, the other emissions deemed to comply with the limit.



RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

PEAK



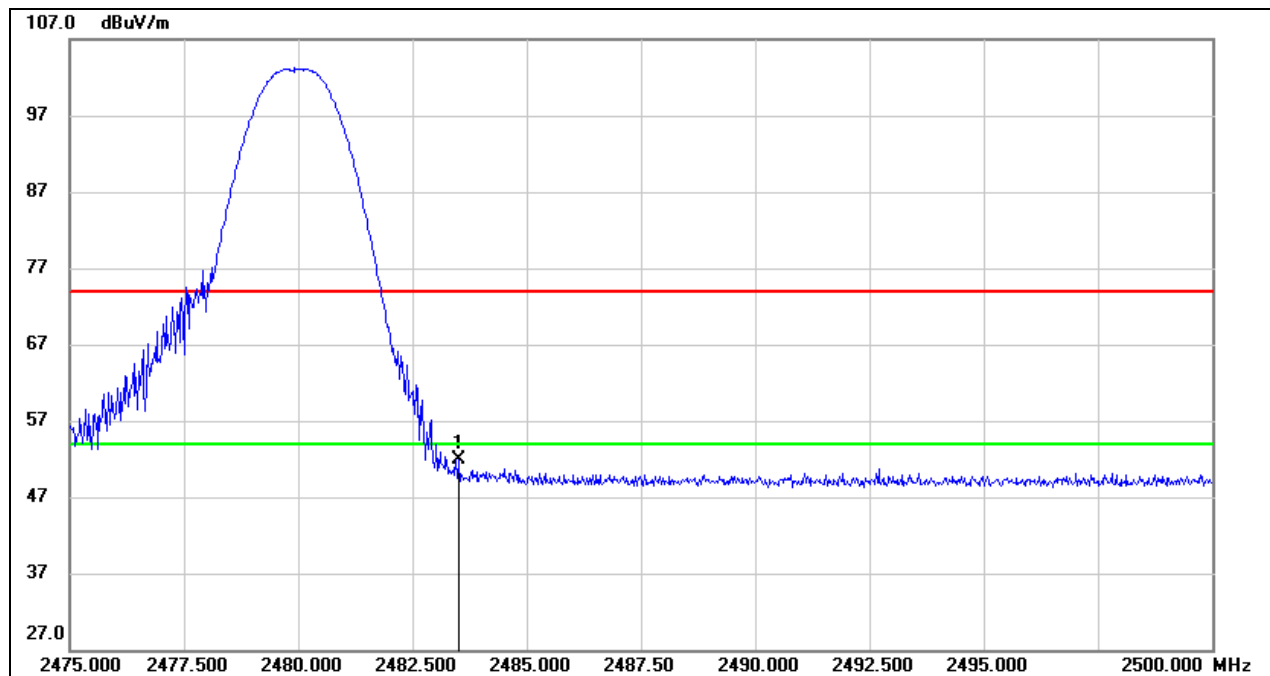
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	19.63	33.58	53.21	74.00	-20.79	peak

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 case emission will be recorder, if it complies with the limit, the other emissions deemed to comply with the limit.



RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

PEAK

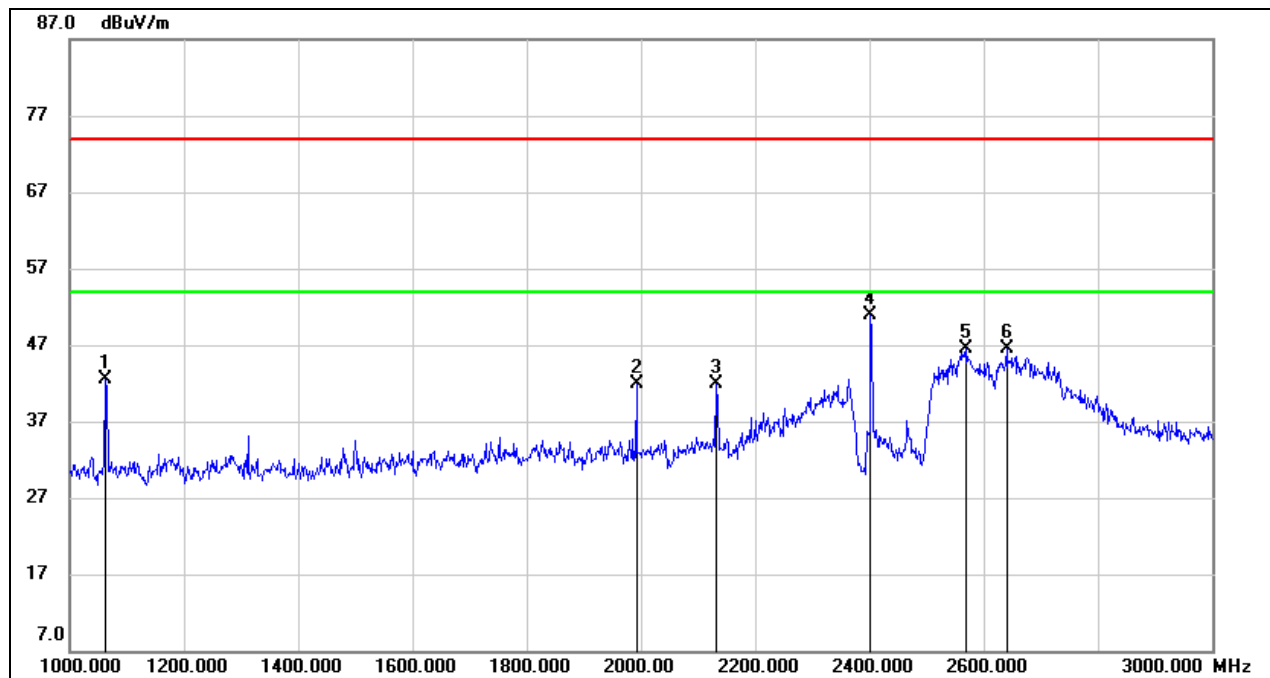


No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	18.32	33.58	51.90	74.00	-22.10	peak

- 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 case emission will be recorder, if it complies with the limit, the other emissions deemed to comply with the limit.

8.2. SPURIOUS EMISSIONS (1~3GHz)

HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, HORIZONTAL)

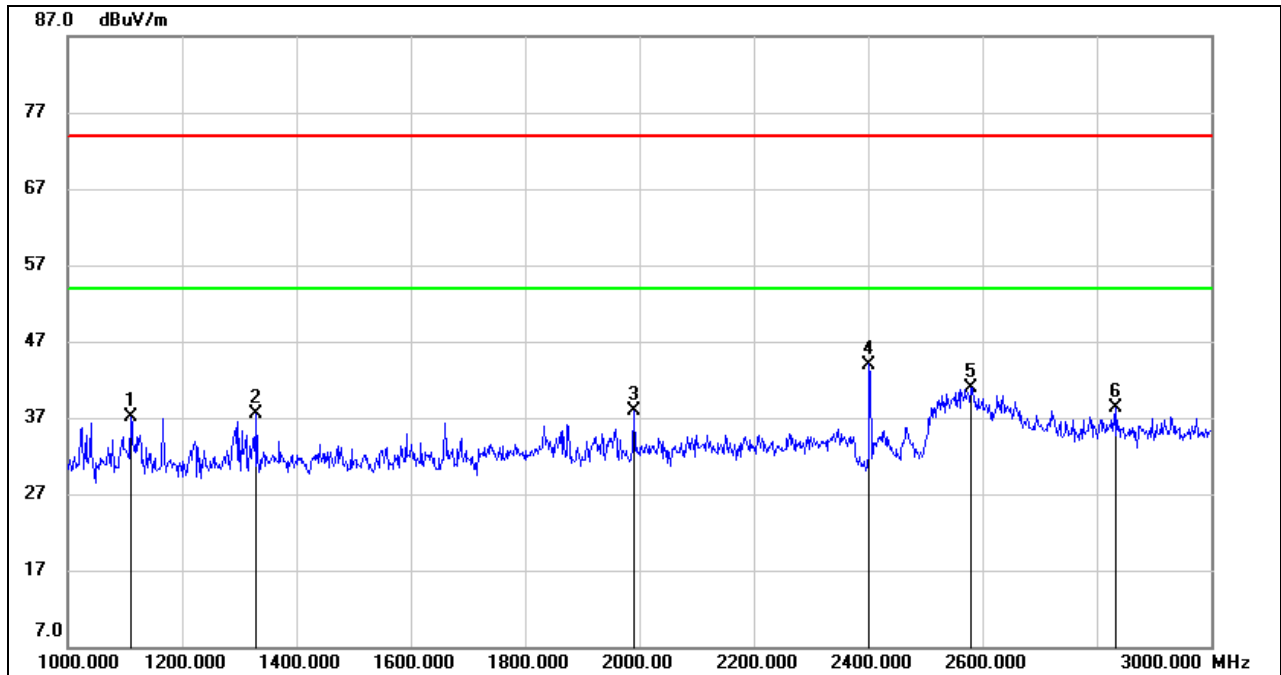


No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1062.000	56.08	-13.55	42.53	74.00	-31.47	peak
2	1992.000	51.74	-9.83	41.91	74.00	-32.09	peak
3	2132.000	50.88	-9.00	41.88	74.00	-32.12	peak
4	2402.000	58.79	-7.85	50.94	/	/	fundamental
5	2570.000	54.08	-7.54	46.54	74.00	-27.46	peak
6	2640.000	53.97	-7.48	46.49	74.00	-27.51	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.



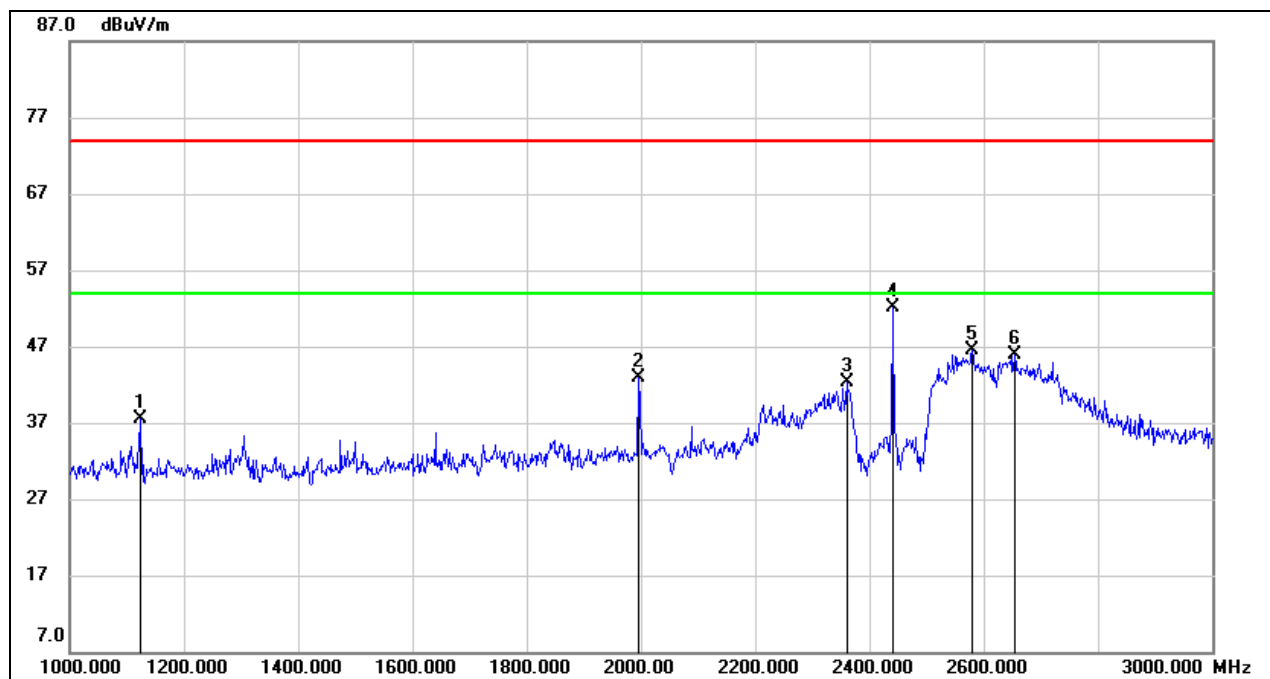
HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, VERTICAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1110.000	50.51	-13.43	37.08	74.00	-36.92	peak
2	1330.000	49.94	-12.36	37.58	74.00	-36.42	peak
3	1990.000	47.81	-9.84	37.97	74.00	-36.03	peak
4	2402.000	51.85	-7.85	44.00	/	/	fundamental
5	2580.000	48.56	-7.59	40.97	74.00	-33.03	peak
6	2834.000	44.18	-5.88	38.30	74.00	-35.70	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)

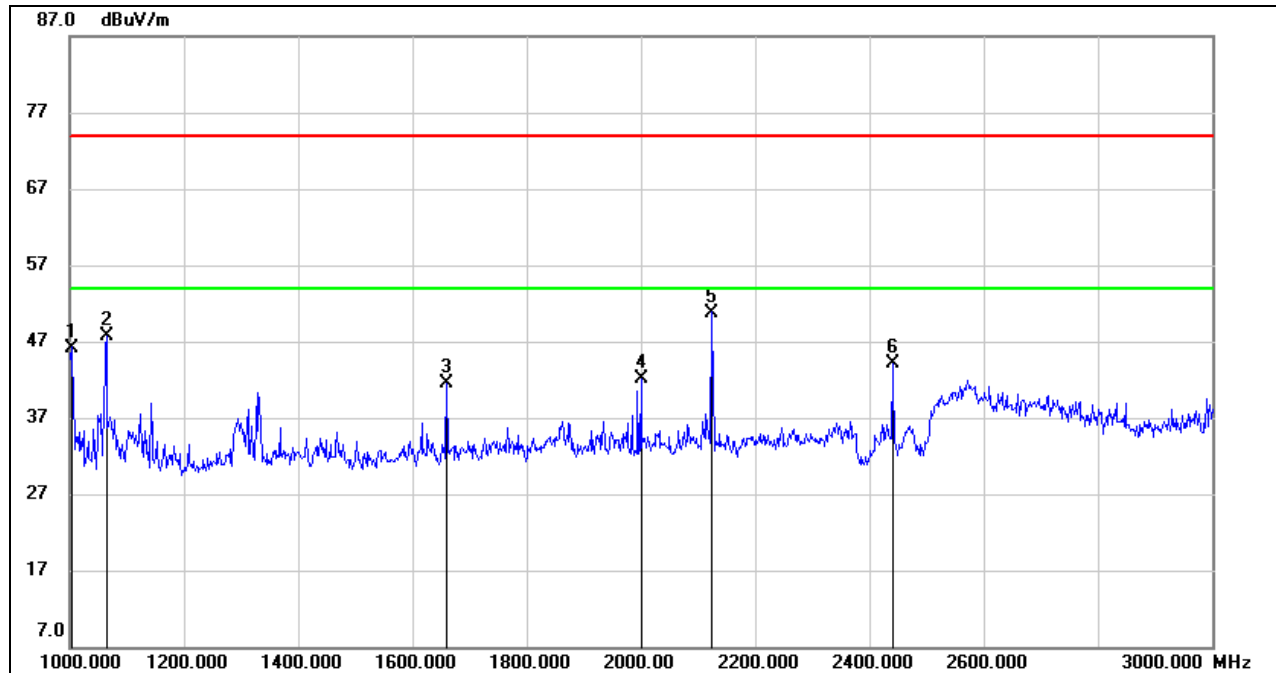


No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1124.000	50.87	-13.32	37.55	74.00	-36.45	peak
2	1996.000	52.80	-9.83	42.97	74.00	-31.03	peak
3	2360.000	50.24	-7.99	42.25	74.00	-31.75	peak
4	2440.000	59.73	-7.59	52.14	/	/	fundamental
5	2580.000	54.15	-7.59	46.56	74.00	-27.44	peak
6	2654.000	53.25	-7.39	45.86	74.00	-28.14	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)

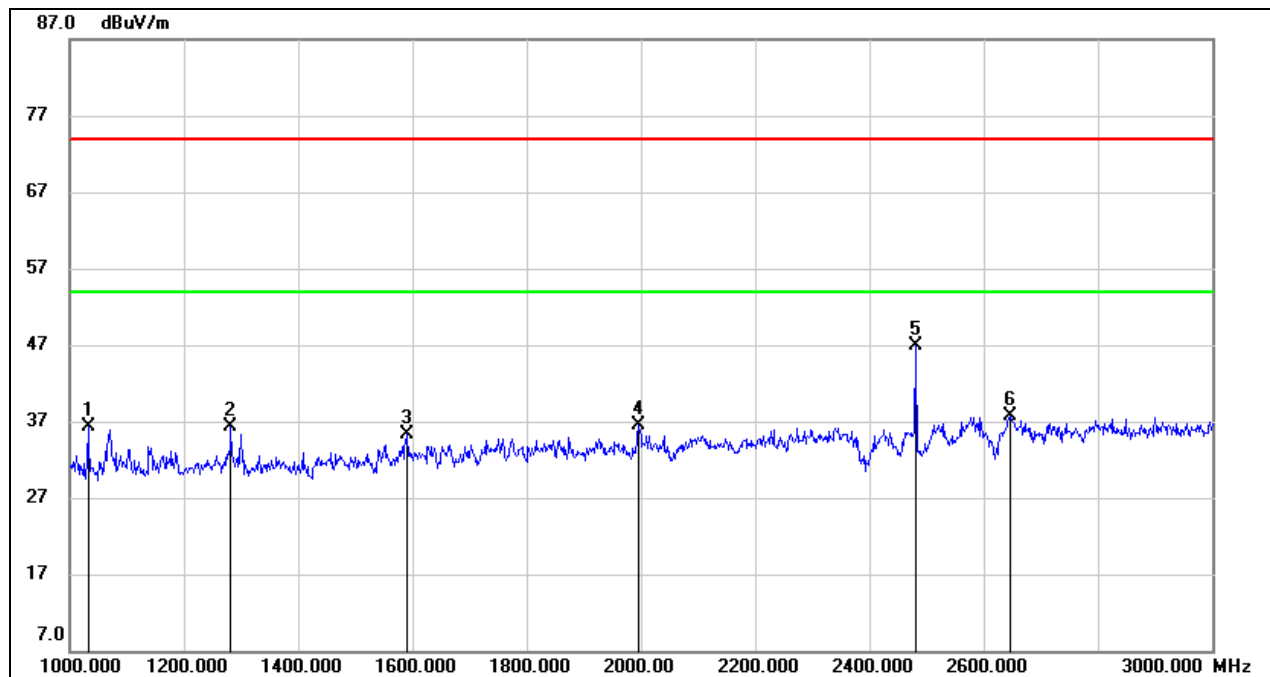


No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1004.000	59.78	-13.58	46.20	74.00	-27.80	peak
2	1064.000	61.20	-13.54	47.66	74.00	-26.34	peak
3	1660.000	52.52	-11.10	41.42	74.00	-32.58	peak
4	2000.000	51.86	-9.82	42.04	74.00	-31.96	peak
5	2124.000	59.84	-9.04	50.80	74.00	-23.20	peak
6	2440.000	51.70	-7.59	44.11	/	/	fundamental

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)

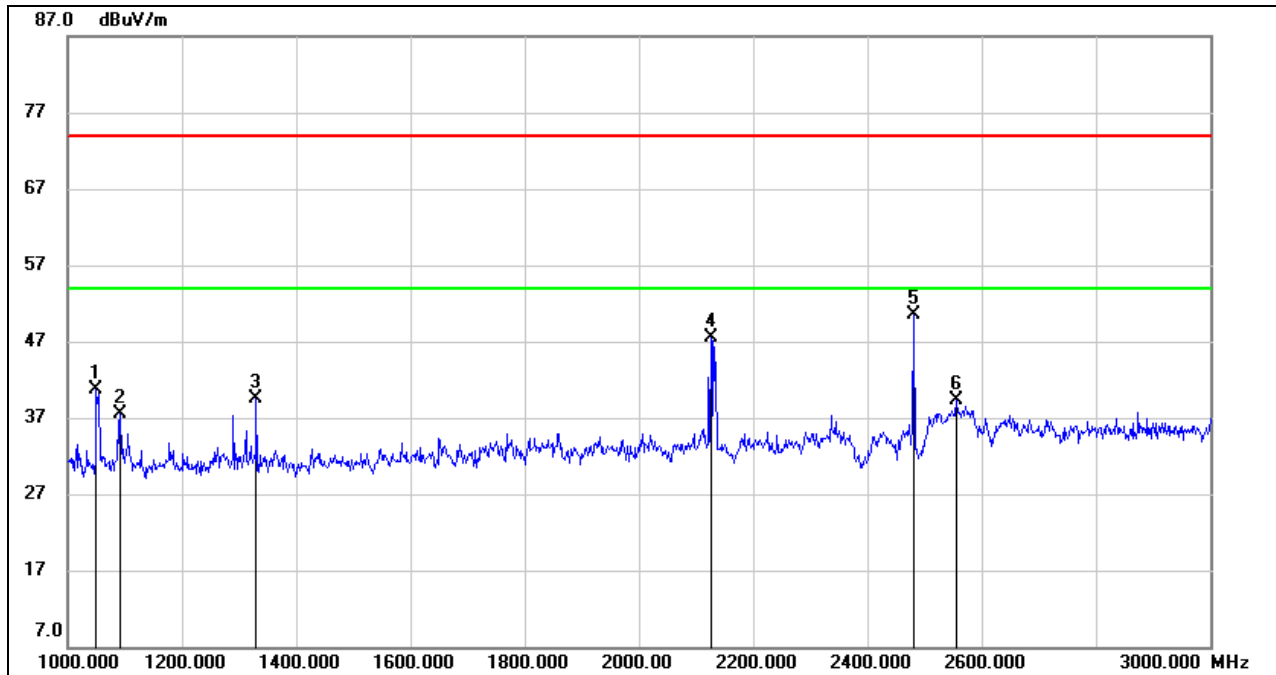


No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1032.000	49.78	-13.57	36.21	74.00	-37.79	peak
2	1282.000	48.62	-12.40	36.22	74.00	-37.78	peak
3	1590.000	46.74	-11.49	35.25	74.00	-38.75	peak
4	1996.000	46.31	-9.83	36.48	74.00	-37.52	peak
5	2480.000	54.13	-7.31	46.82	/	/	fundamental
6	2646.000	45.11	-7.44	37.67	74.00	-36.33	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)



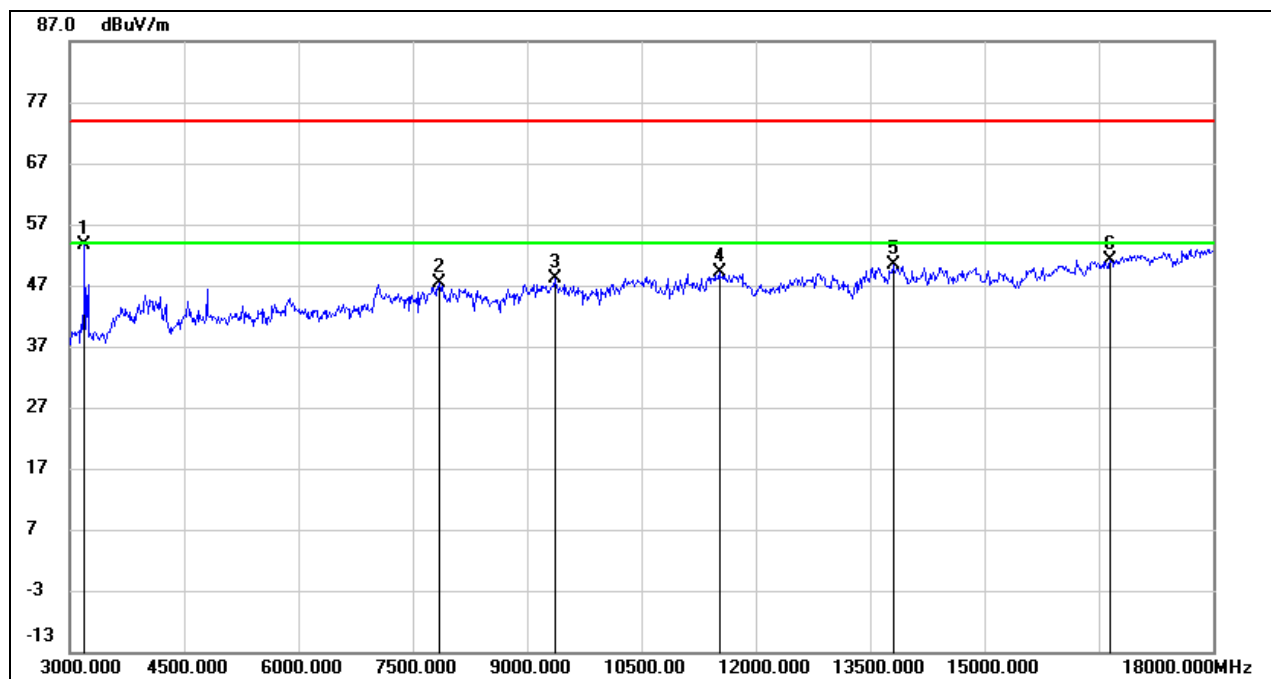
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1050.000	54.20	-13.55	40.65	74.00	-33.35	peak
2	1092.000	51.10	-13.52	37.58	74.00	-36.42	peak
3	1330.000	51.79	-12.36	39.43	74.00	-34.57	peak
4	2126.000	56.51	-9.02	47.49	74.00	-26.51	peak
5	2480.000	57.79	-7.31	50.48	/	/	fundamental
6	2556.000	46.84	-7.47	39.37	74.00	-34.63	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 (3~18GHz)

HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, HORIZONTAL)

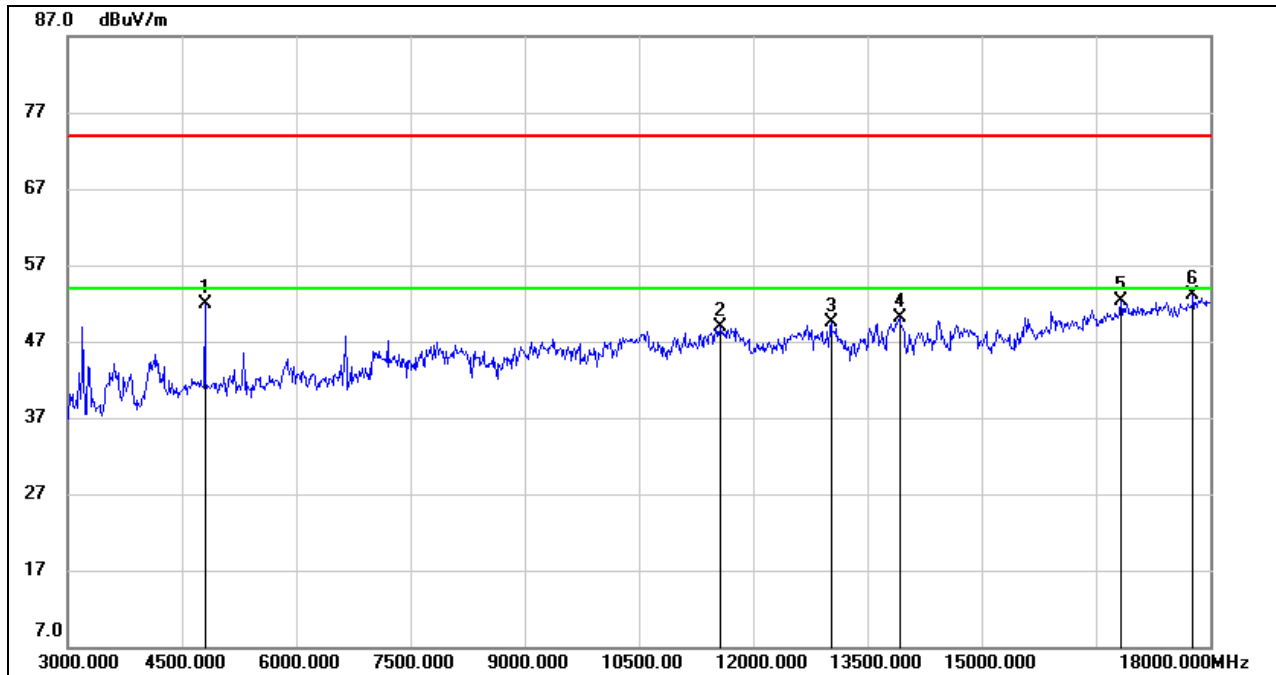


No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3195.000	58.16	-4.42	53.74	74.00	-20.26	peak
2	7845.000	39.72	7.62	47.34	74.00	-26.66	peak
3	9360.000	38.78	9.36	48.14	74.00	-25.86	peak
4	11520.000	35.77	13.38	49.15	74.00	-24.85	peak
5	13800.000	33.23	17.10	50.33	74.00	-23.67	peak
6	16650.000	31.43	19.70	51.13	74.00	-22.87	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. 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.



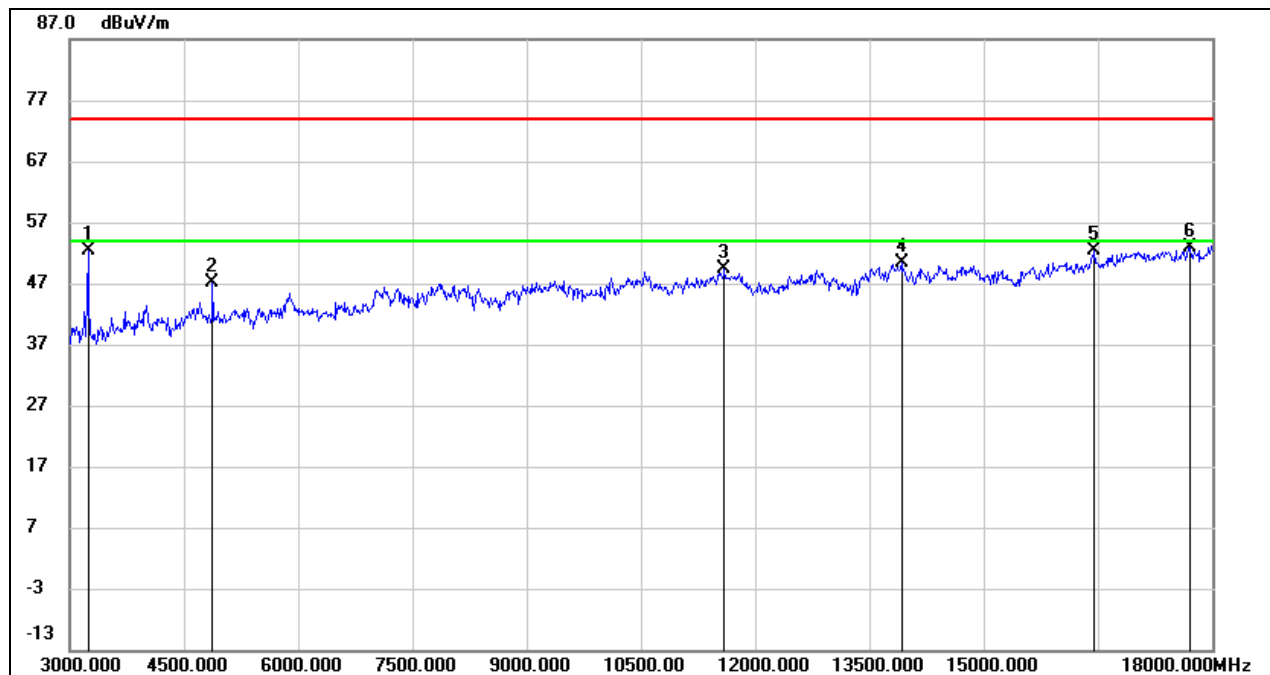
HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, VERTICAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4800.000	51.43	0.46	51.89	74.00	-22.11	peak
2	11565.000	35.66	13.26	48.92	74.00	-25.08	peak
3	13020.000	34.47	14.98	49.45	74.00	-24.55	peak
4	13920.000	33.93	16.17	50.10	74.00	-23.90	peak
5	16830.000	32.25	19.96	52.21	74.00	-21.79	peak
6	17775.000	30.01	23.09	53.10	74.00	-20.90	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. 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)

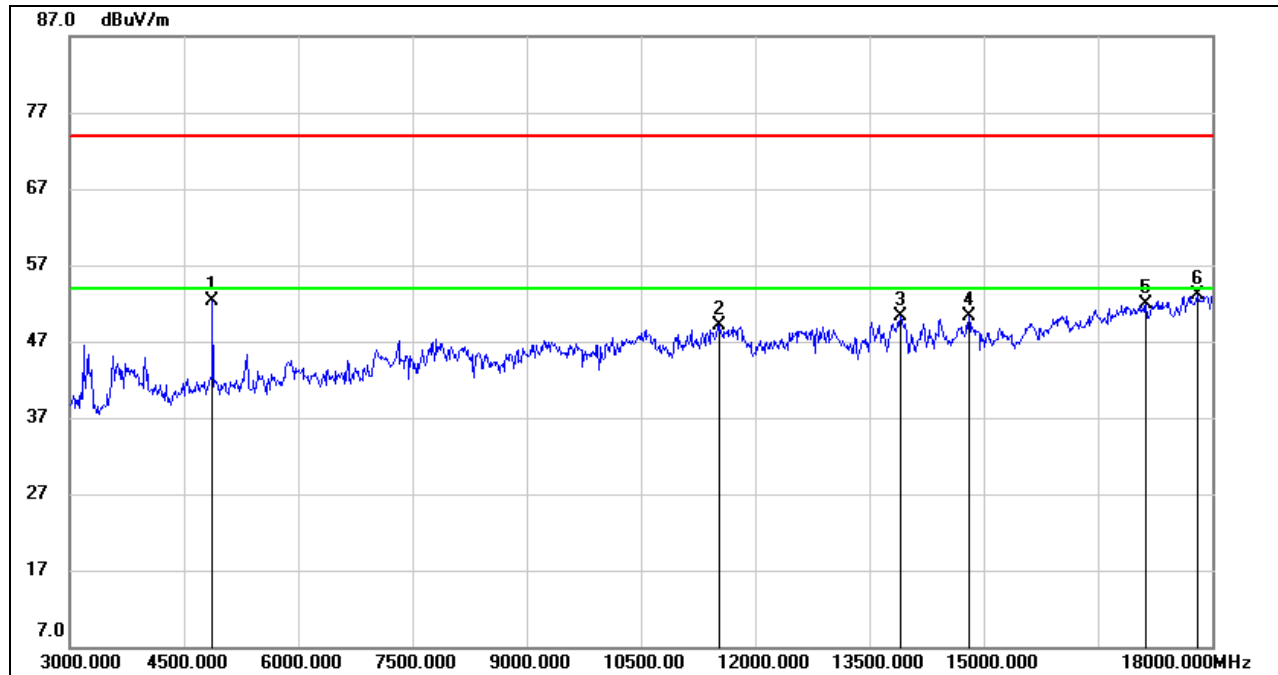


No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3240.000	56.64	-4.37	52.27	74.00	-21.73	peak
2	4875.000	46.40	0.76	47.16	74.00	-26.84	peak
3	11595.000	36.11	13.19	49.30	74.00	-24.70	peak
4	13920.000	34.12	16.17	50.29	74.00	-23.71	peak
5	16455.000	33.27	19.00	52.27	74.00	-21.73	peak
6	17700.000	30.55	22.43	52.98	74.00	-21.02	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. 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)

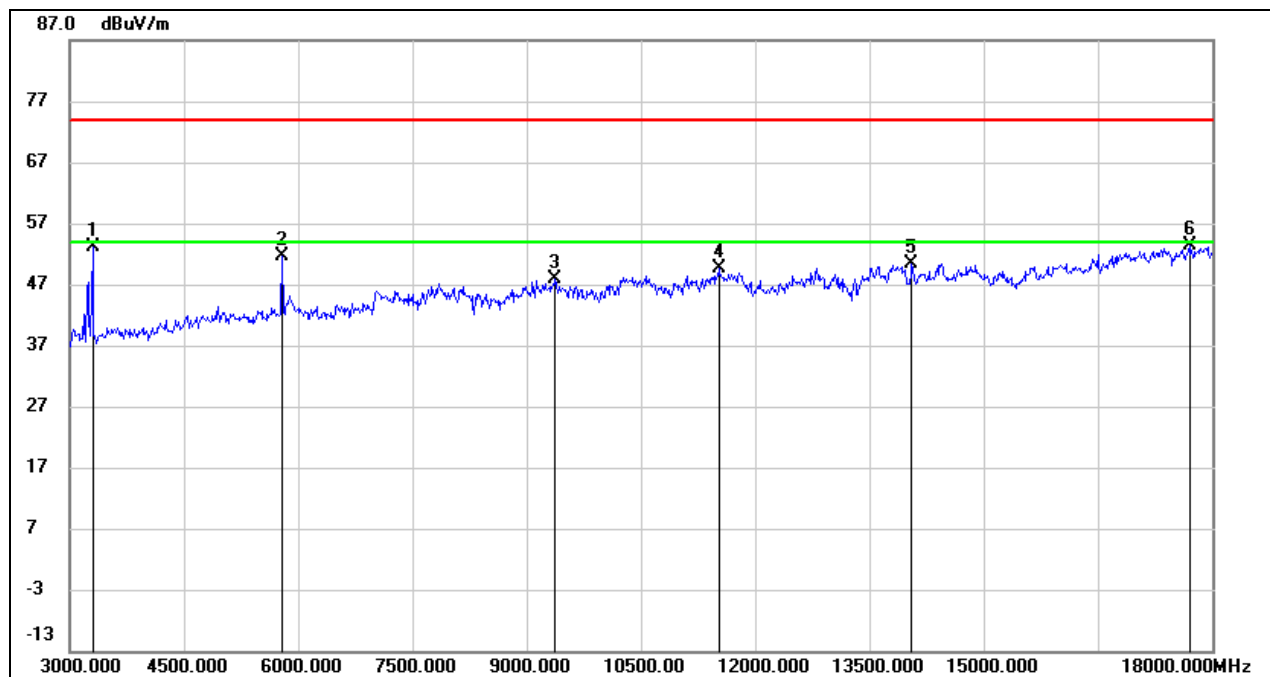


No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4875.000	51.59	0.76	52.35	74.00	-21.65	peak
2	11535.000	35.79	13.33	49.12	74.00	-24.88	peak
3	13905.000	34.08	16.20	50.28	74.00	-23.72	peak
4	14805.000	34.47	15.92	50.39	74.00	-23.61	peak
5	17130.000	31.25	20.72	51.97	74.00	-22.03	peak
6	17805.000	29.71	23.31	53.02	74.00	-20.98	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. 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)

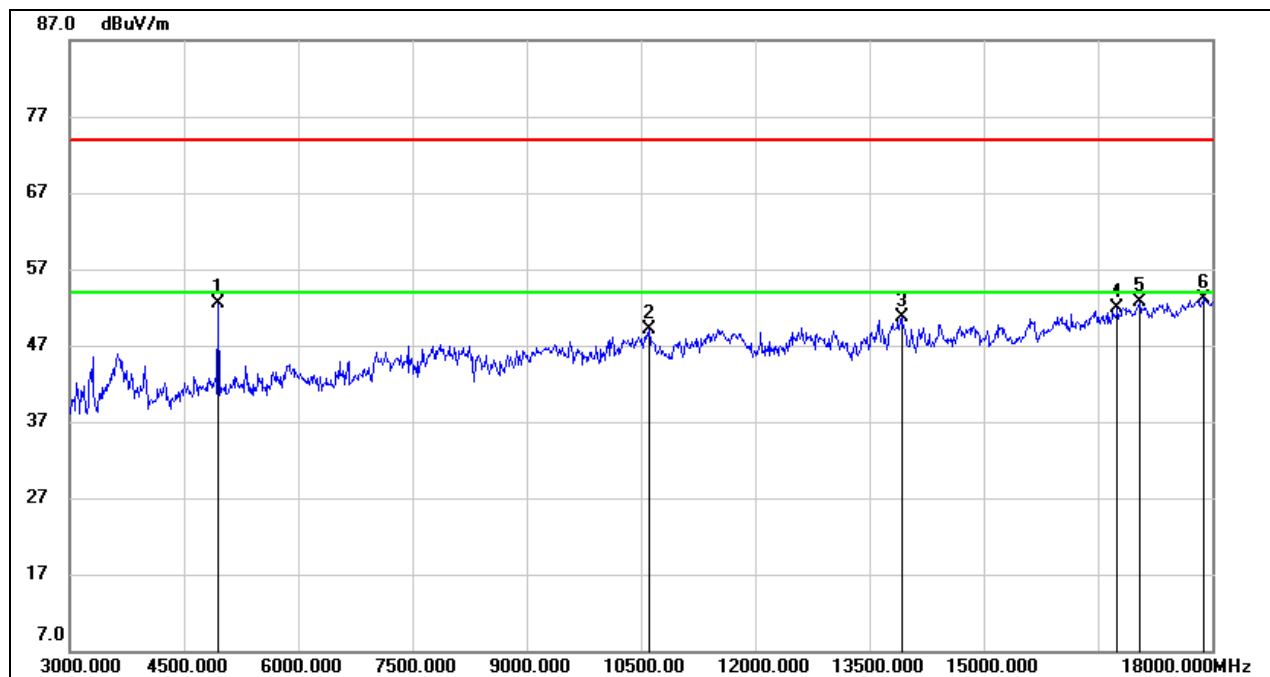


No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3300.000	57.46	-4.24	53.22	74.00	-20.78	peak
2	5790.000	48.68	3.05	51.73	74.00	-22.27	peak
3	9375.000	38.52	9.45	47.97	74.00	-26.03	peak
4	11520.000	36.33	13.38	49.71	74.00	-24.29	peak
5	14055.000	34.38	16.01	50.39	74.00	-23.61	peak
6	17700.000	31.04	22.43	53.47	74.00	-20.53	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. 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)

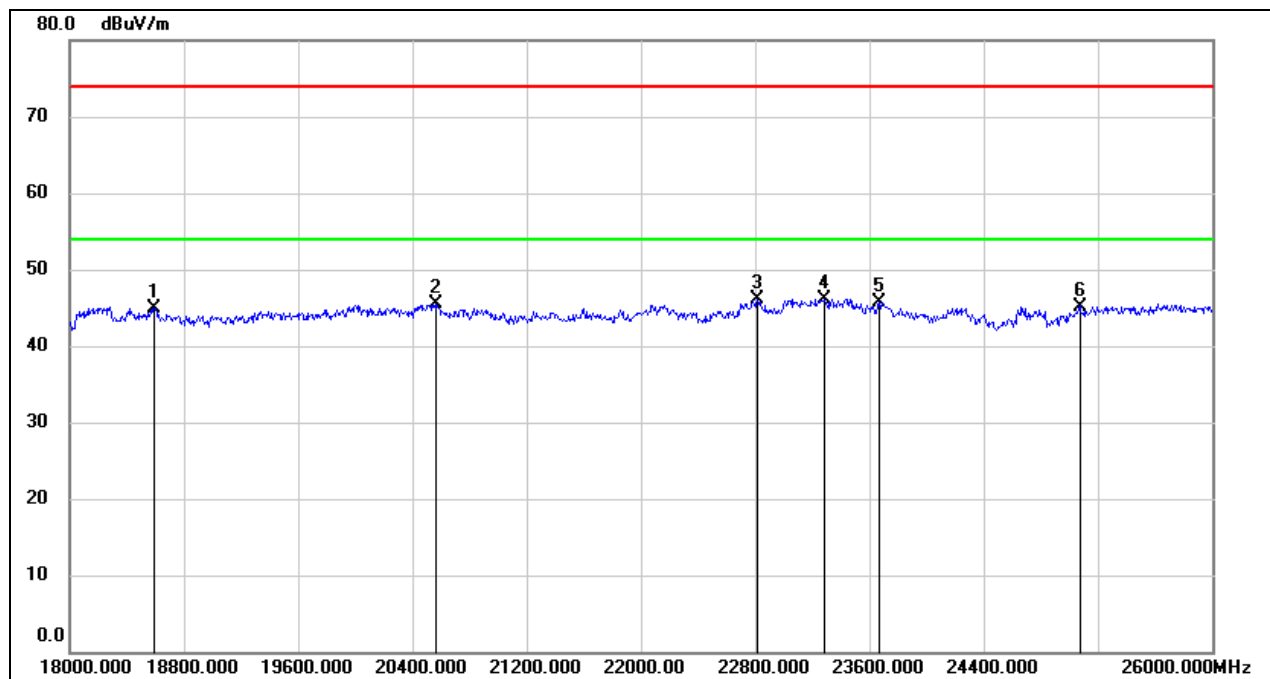


No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4950.000	51.34	1.13	52.47	74.00	-21.53	peak
2	10605.000	37.09	11.93	49.02	74.00	-24.98	peak
3	13920.000	34.59	16.17	50.76	74.00	-23.24	peak
4	16755.000	32.02	19.94	51.96	74.00	-22.04	peak
5	17055.000	32.19	20.53	52.72	74.00	-21.28	peak
6	17895.000	29.86	23.34	53.20	74.00	-20.80	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. 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 18G ~ 26GHz

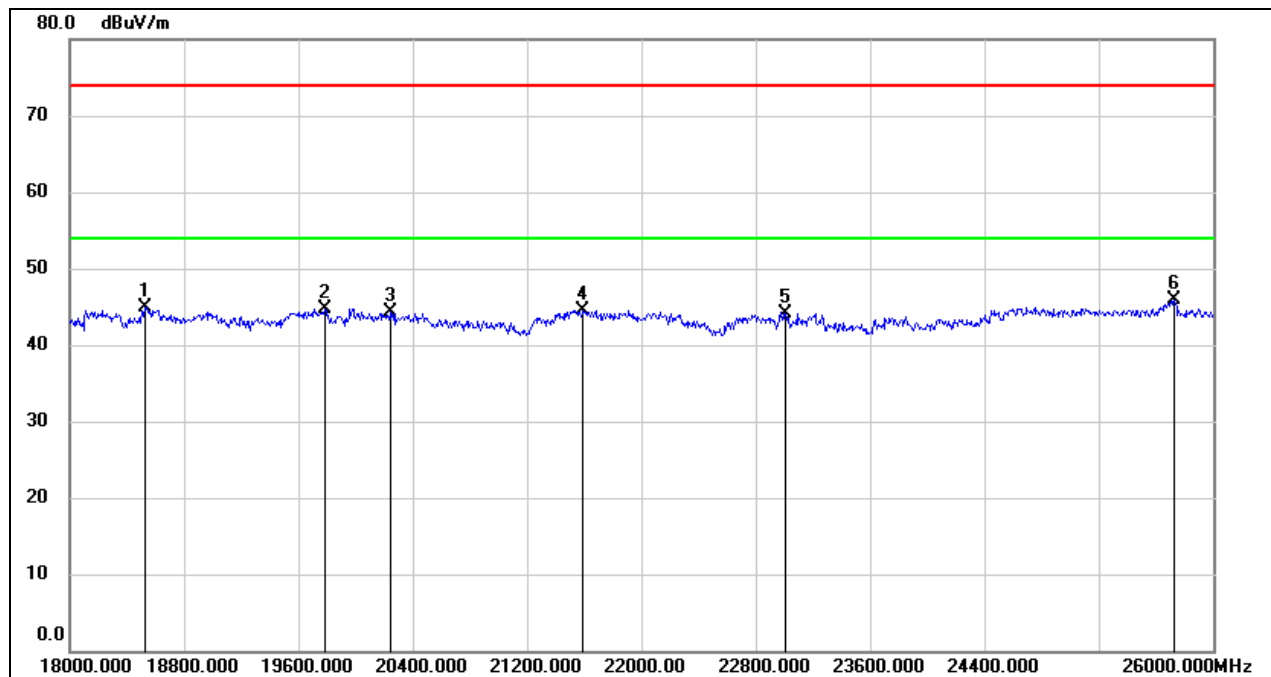
SPURIOUS EMISSIONS (MID CHANNEL, WORST-CASE CONFIGURATION, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	18592.000	50.25	-5.31	44.94	74.00	-29.06	peak
2	20560.000	50.73	-5.30	45.43	74.00	-28.57	peak
3	22816.000	49.66	-3.63	46.03	74.00	-27.97	peak
4	23288.000	49.43	-3.33	46.10	74.00	-27.90	peak
5	23664.000	48.82	-3.18	45.64	74.00	-28.36	peak
6	25072.000	47.17	-1.97	45.20	74.00	-28.80	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. The preamplifier only effect to the above 18GHz signal and no filter added to the measurement chain.

SPURIOUS EMISSIONS (MID 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	20240.000	49.82	-5.61	44.21	74.00	-29.79	peak
4	21592.000	49.14	-4.55	44.59	74.00	-29.41	peak
5	23008.000	47.60	-3.44	44.16	74.00	-29.84	peak
6	25728.000	46.61	-0.72	45.89	74.00	-28.11	peak

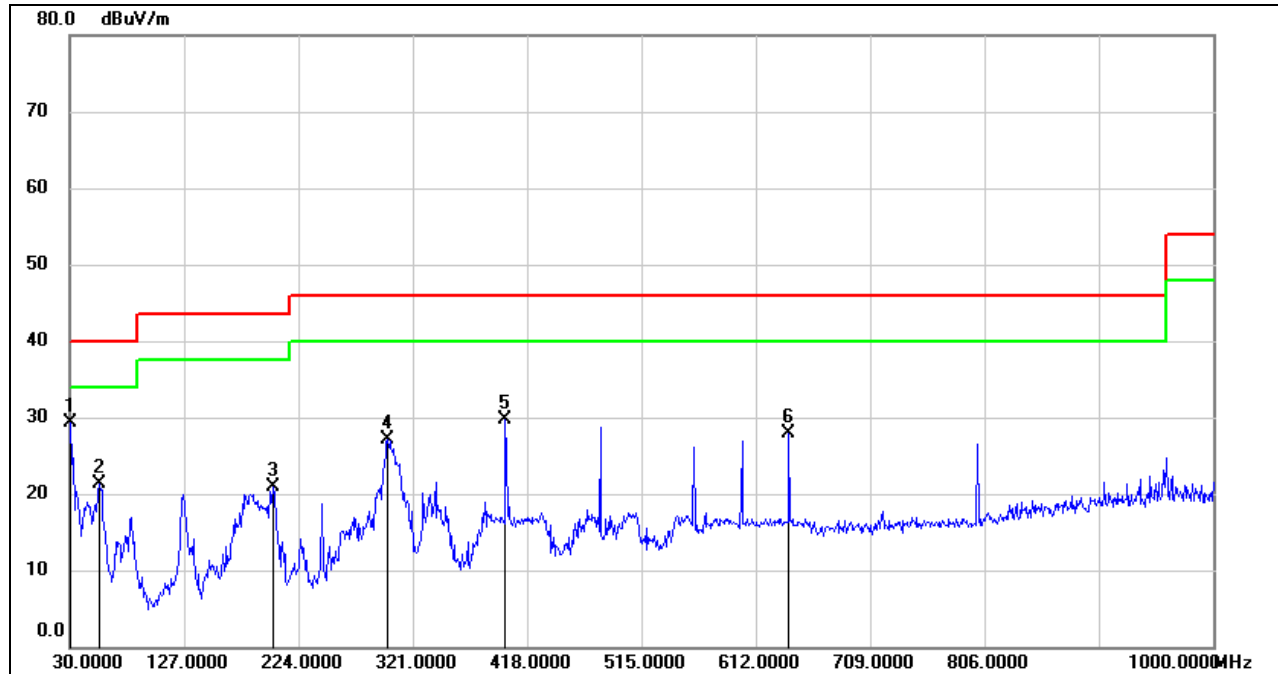
Note: 1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. The preamplifier only effect to the above 18GHz signal and no filter added to the measurement chain.

Note: All the test modes and channels have been tested, only the worst data record in the report.



8.5. SPURIOUS EMISSIONS 30M ~ 1 GHz

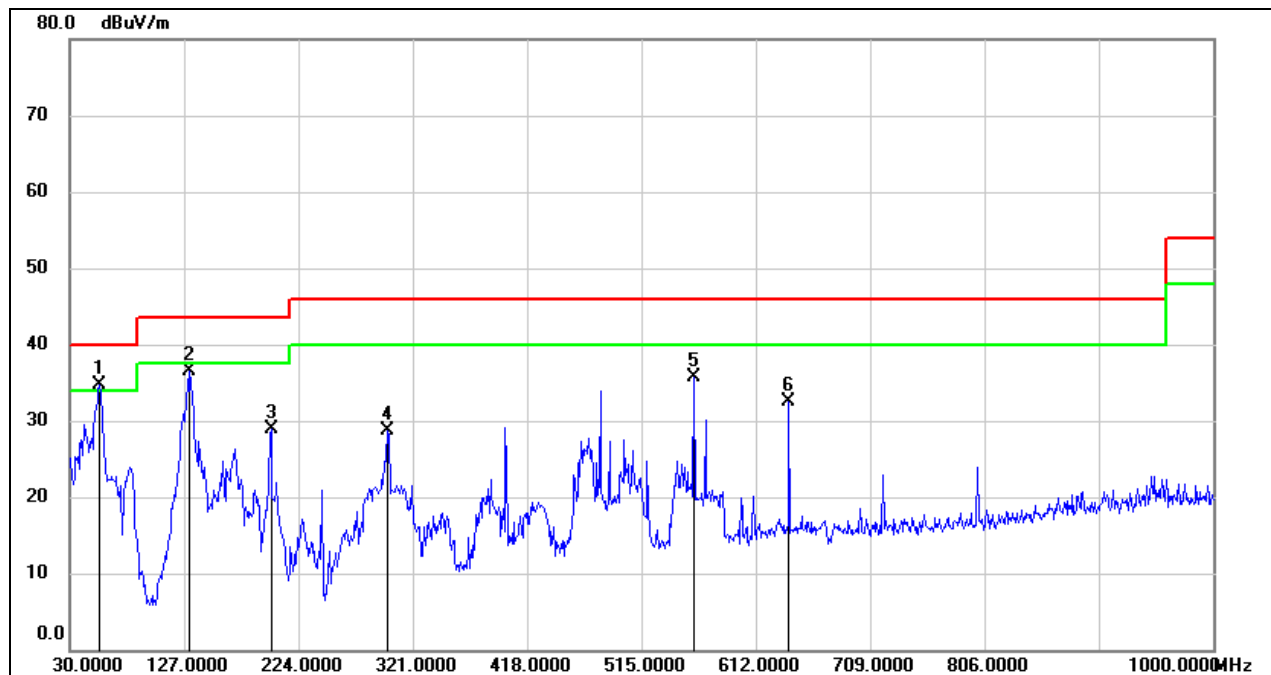
SPURIOUS EMISSIONS (MID CHANNEL, WORST-CASE CONFIGURATION, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	30.9700	48.41	-19.14	29.27	40.00	-10.73	QP
2	55.2200	42.04	-20.76	21.28	40.00	-18.72	QP
3	202.6600	37.68	-16.75	20.93	43.50	-22.57	QP
4	299.6600	42.61	-15.60	27.01	46.00	-18.99	QP
5	399.5700	43.21	-13.51	29.70	46.00	-16.30	QP
6	640.1300	37.43	-9.46	27.97	46.00	-18.03	QP

Note: 1. Result Level = Read Level + Correct Factor.
2. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.

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



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	55.2200	55.52	-20.76	34.76	40.00	-5.24	QP
2	130.8800	55.95	-19.53	36.42	43.50	-7.08	QP
3	200.7200	45.55	-16.60	28.95	43.50	-14.55	QP
4	299.6600	44.26	-15.60	28.66	46.00	-17.34	QP
5	559.6200	46.38	-10.66	35.72	46.00	-10.28	QP
6	640.1300	41.95	-9.46	32.49	46.00	-13.51	QP

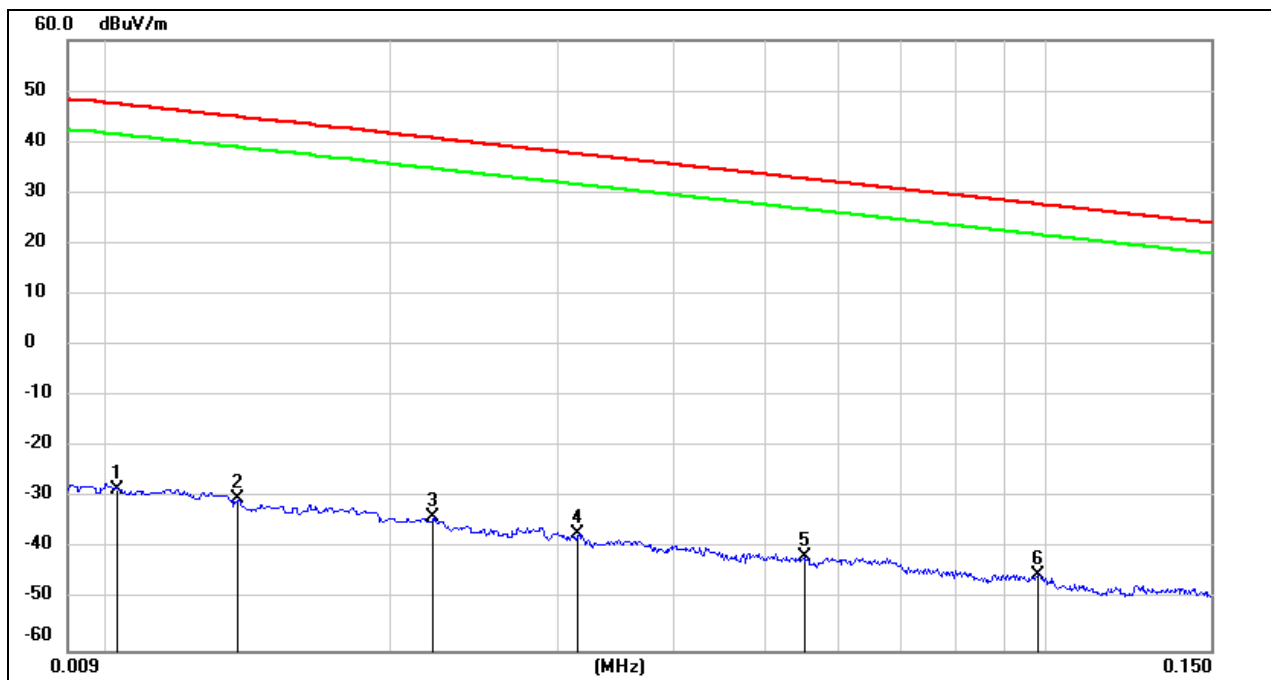
Note: 1. Result Level = Read Level + Correct Factor.
2. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.

Note: All the test modes and channels have been tested, only the worst data record in the report.

8.6. SPURIOUS EMISSIONS BELOW 30M

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

9kHz~ 150kHz



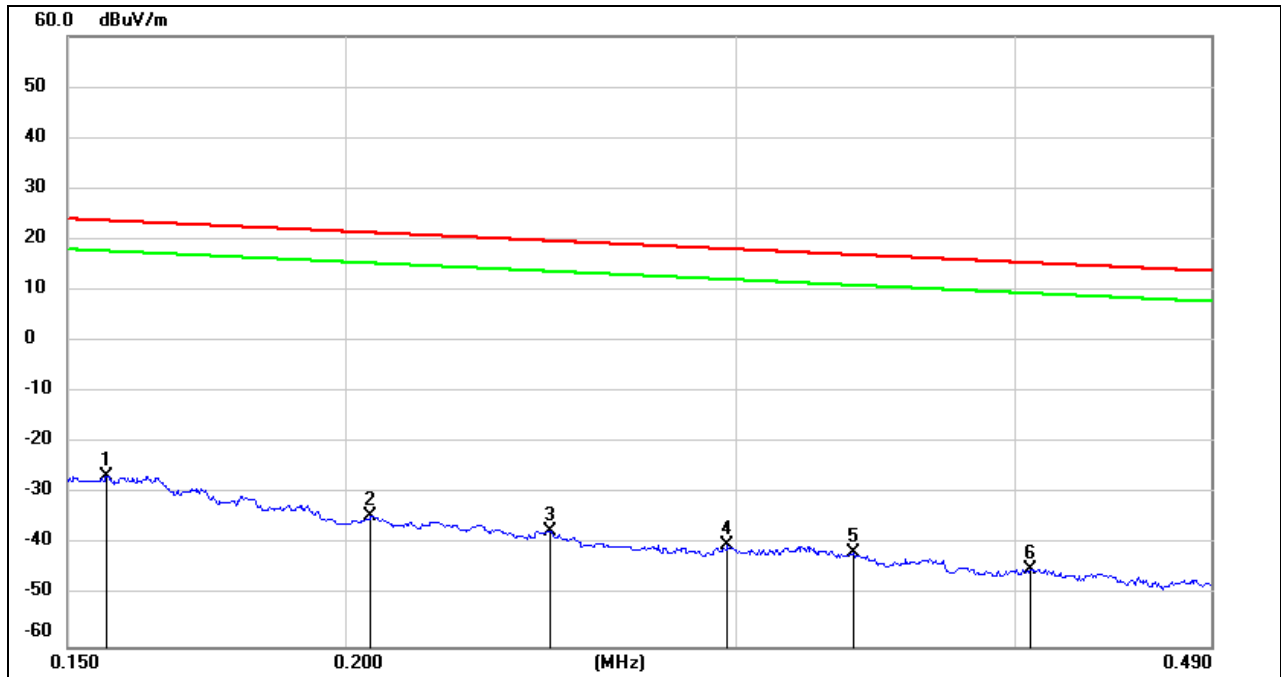
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	0.0102	73.05	-101.40	-28.35	47.43	-75.78	peak
2	0.0137	71.22	-101.38	-30.16	44.87	-75.03	peak
3	0.0221	67.63	-101.35	-33.72	40.71	-74.43	peak
4	0.0316	64.24	-101.40	-37.16	37.61	-74.77	peak
5	0.0551	59.95	-101.50	-41.55	32.78	-74.33	peak
6	0.0981	56.77	-101.78	-45.01	27.77	-72.78	peak

Note:

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



150kHz ~ 490kHz

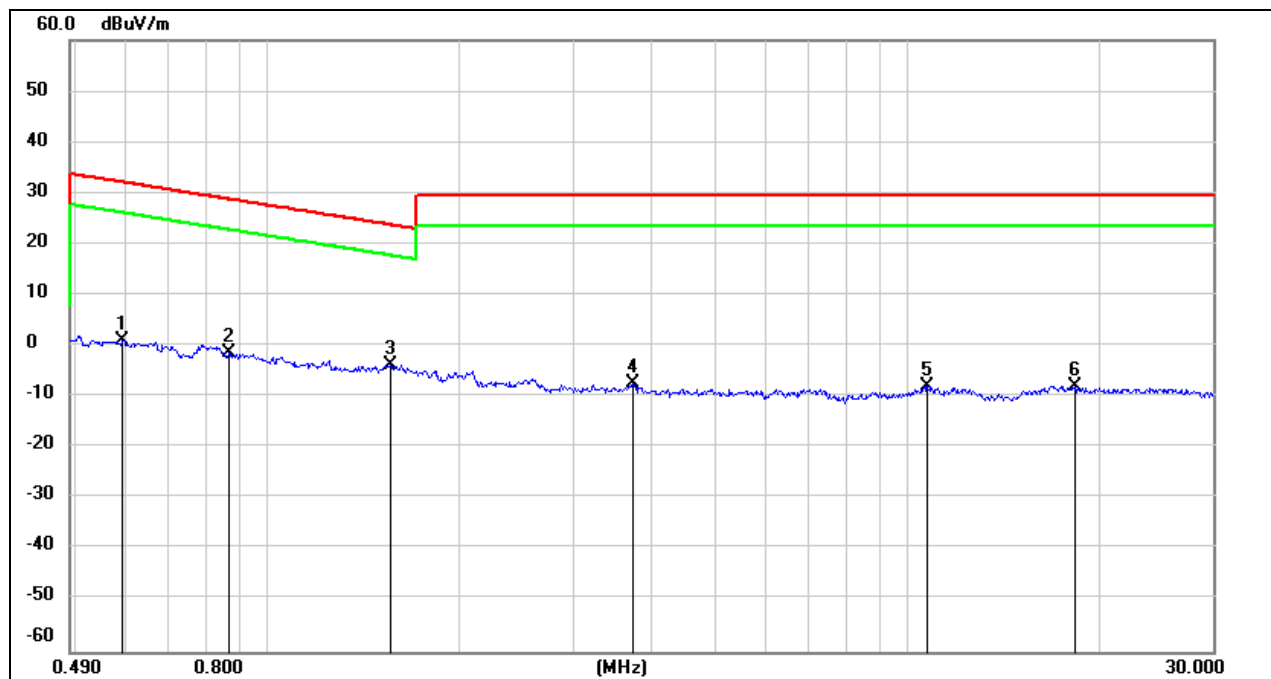


No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	0.1562	75.09	-101.65	-26.56	23.73	-50.29	peak
2	0.2053	67.30	-101.73	-34.43	21.35	-55.78	peak
3	0.2472	64.45	-101.80	-37.35	19.74	-57.09	peak
4	0.2972	61.66	-101.85	-40.19	18.14	-58.33	peak
5	0.3382	60.23	-101.90	-41.67	17.02	-58.69	peak
6	0.4062	57.14	-101.96	-44.82	15.43	-60.25	peak

Note:

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

490kHz ~ 30MHz



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	0.5917	63.24	-62.08	1.16	32.16	-31.00	peak
2	0.8679	60.85	-62.18	-1.33	28.83	-30.16	peak
3	1.5564	58.18	-62.02	-3.84	23.76	-27.60	peak
4	3.7100	54.20	-61.41	-7.21	29.54	-36.75	peak
5	10.7299	52.98	-60.83	-7.85	29.54	-37.39	peak
6	18.2545	52.93	-60.90	-7.97	29.54	-37.51	peak

Note:

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

Note: All the test modes and channels have been tested, only the worst data record in the report.

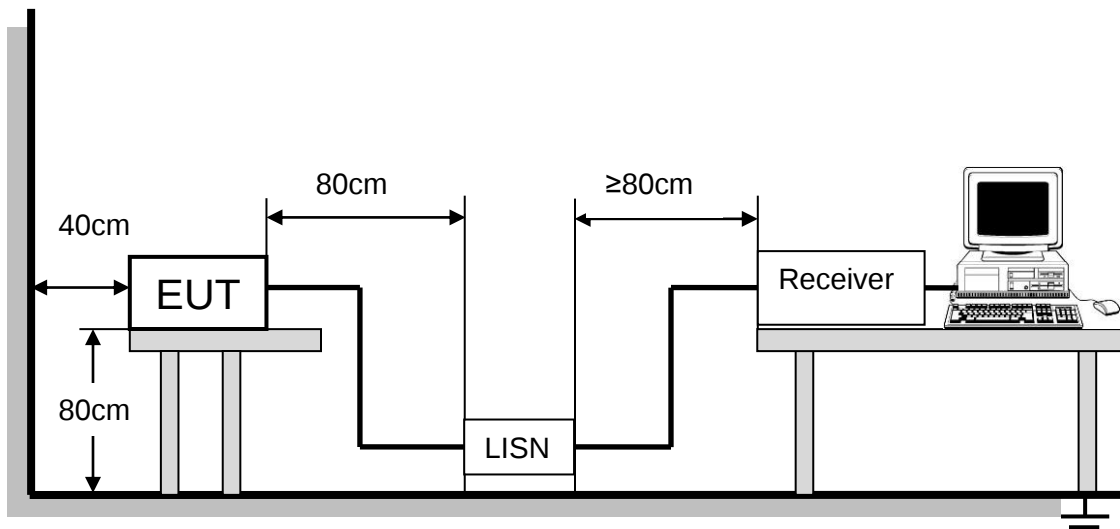
9. AC POWER LINE CONDUCTED EMISSIONS

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



The EUT is put on a table of non-conducting material that is 80cm high. The vertical conducting wall of shielding is located 40cm 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 30MHz using CISPR Quasi-Peak and average detector mode. The bandwidth of EMI test receiver is set at 9kHz.

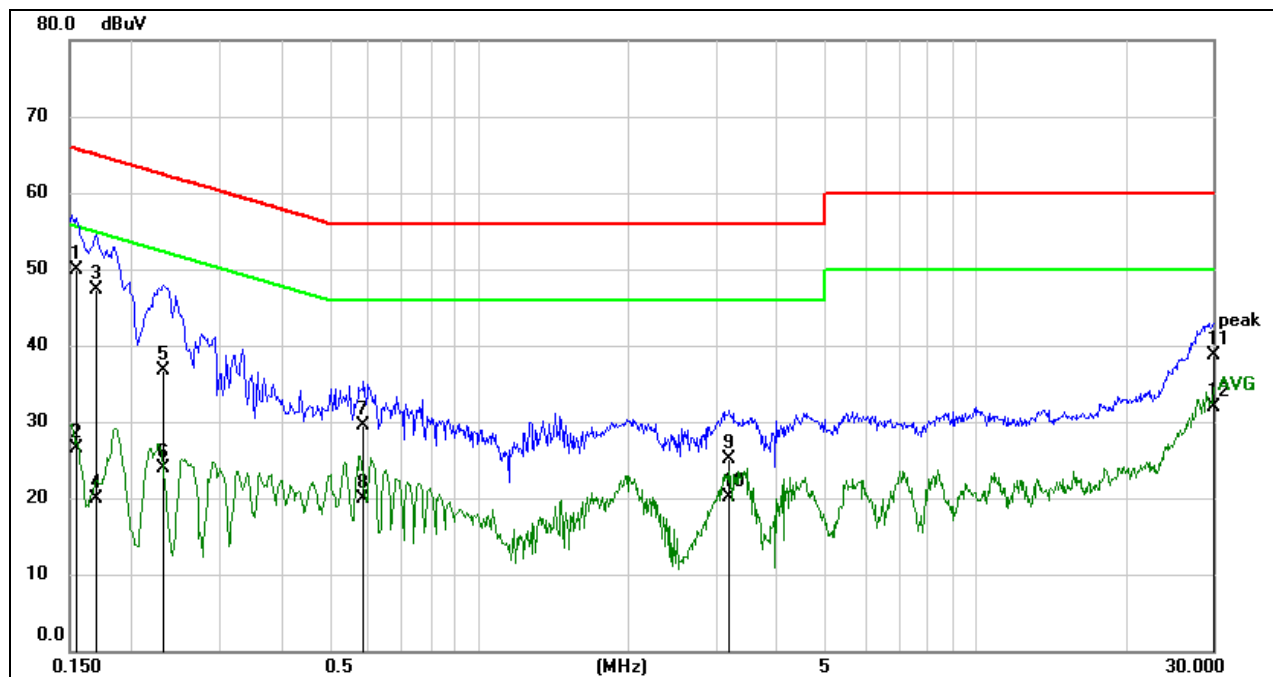
The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application.

TEST ENVIRONMENT

Temperature	26.4°C	Relative Humidity	62.2%
Atmosphere Pressure	101kPa	Test Voltage	AC 120V,60Hz



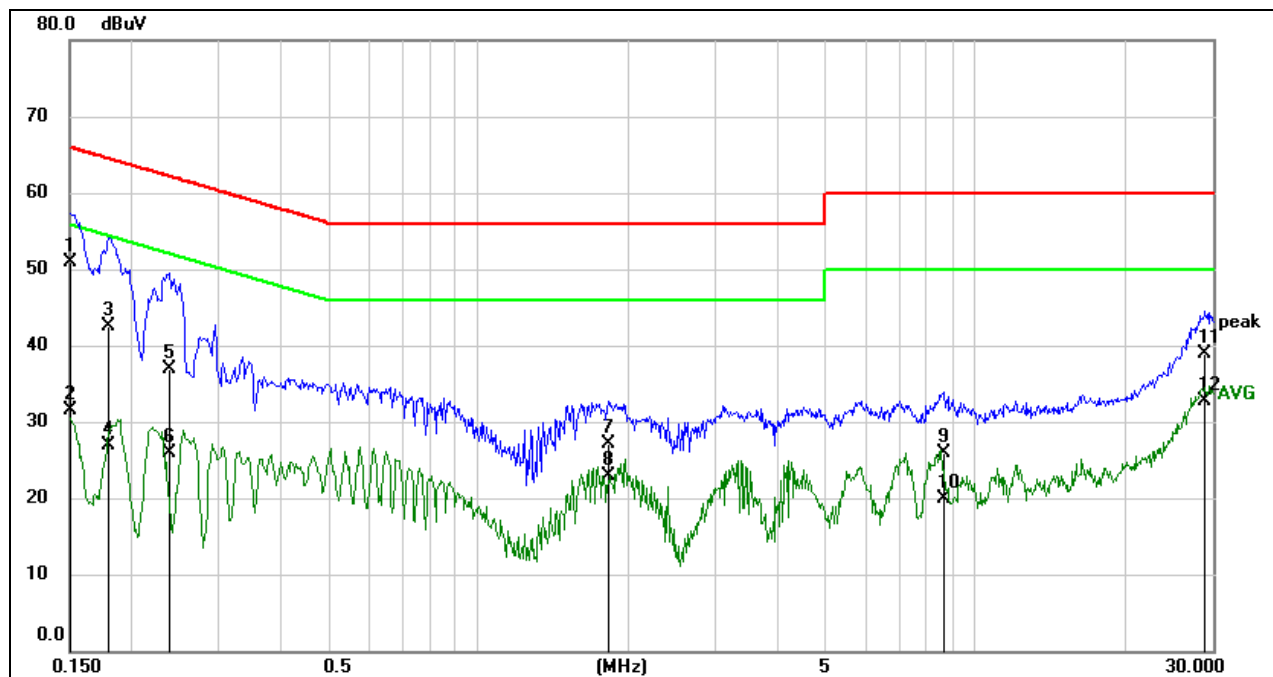
LINE N RESULTS (MID CHANNEL, WORST-CASE CONFIGURATION)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1547	40.24	9.61	49.85	65.74	-15.89	QP
2	0.1547	16.86	9.61	26.47	55.74	-29.27	AVG
3	0.1700	37.67	9.61	47.28	64.96	-17.68	QP
4	0.1700	10.27	9.61	19.88	54.96	-35.08	AVG
5	0.2316	27.18	9.60	36.78	62.39	-25.61	QP
6	0.2316	14.28	9.60	23.88	52.39	-28.51	AVG
7	0.5856	19.87	9.60	29.47	56.00	-26.53	QP
8	0.5856	10.25	9.60	19.85	46.00	-26.15	AVG
9	3.2058	15.52	9.64	25.16	56.00	-30.84	QP
10	3.2058	10.53	9.64	20.17	46.00	-25.83	AVG
11	30.0000	28.97	9.78	38.75	60.00	-21.25	QP
12	30.0000	22.07	9.78	31.85	50.00	-18.15	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: 80Hz (0.009MHz-0.15MHz), 4 kHz (0.15MHz-30MHz), Scan time: auto.

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



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1500	41.23	9.61	50.84	66.00	-15.16	QP
2	0.1500	21.97	9.61	31.58	56.00	-24.42	AVG
3	0.1796	32.97	9.61	42.58	64.50	-21.92	QP
4	0.1796	17.26	9.61	26.87	54.50	-27.63	AVG
5	0.2379	27.27	9.60	36.87	62.17	-25.30	QP
6	0.2379	16.29	9.60	25.89	52.17	-26.28	AVG
7	1.8220	17.44	9.62	27.06	56.00	-28.94	QP
8	1.8220	13.27	9.62	22.89	46.00	-23.11	AVG
9	8.6539	16.26	9.73	25.99	60.00	-34.01	QP
10	8.6539	10.12	9.73	19.85	50.00	-30.15	AVG
11	29.0420	29.06	9.81	38.87	60.00	-21.13	QP
12	29.0420	22.85	9.81	32.66	50.00	-17.34	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: 80Hz (0.009MHz-0.15MHz), 4 kHz (0.15MHz-30MHz), Scan time: auto.

Note: All the test modes and channels have been tested, only the worst data record 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: DUTY CYCLE

11.1.1. Test Result

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	2.09	2.50	0.836	83.6	0.778	0.48	0.5

Note:

Duty Cycle Correction Factor= $10\log(1/x)$.

Where: x is Duty Cycle(Linear)

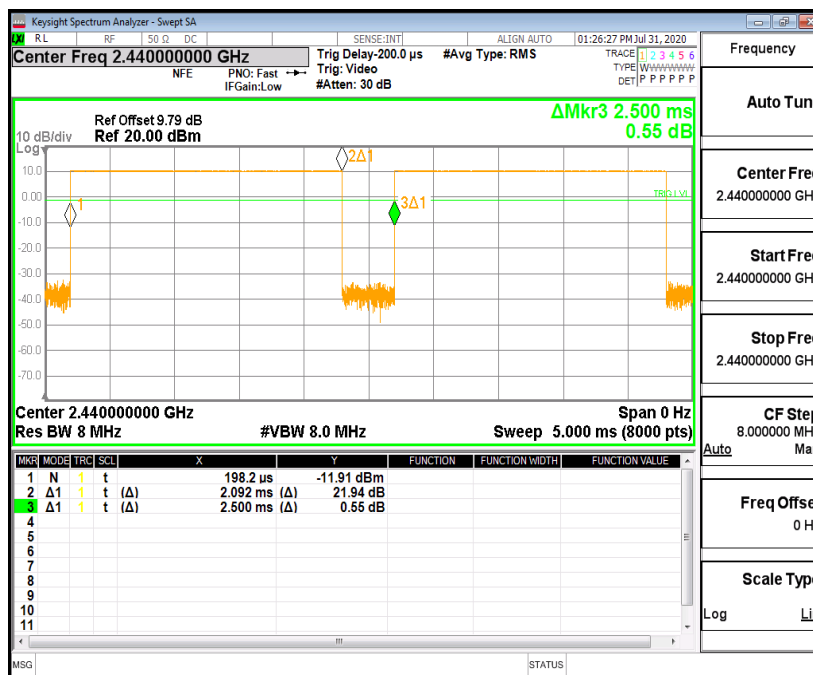
Where: T is On Time (transmit duration)

If that calculated VBW is not available on the analyzer then the next higher value should be used.



11.1.1. Test Graphs

ON TIME AND DUTY CYCLE MID CH





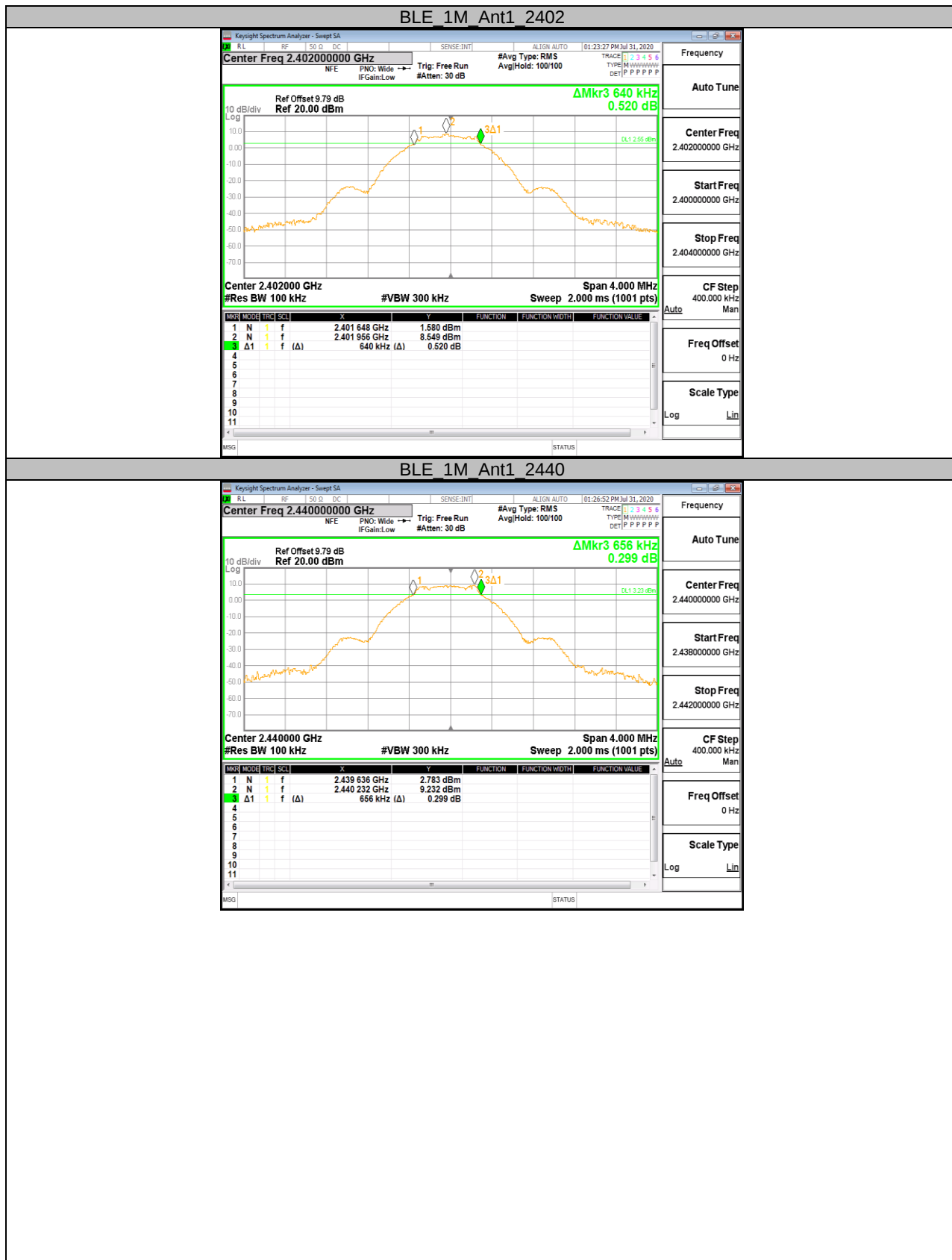
11.2. Appendix B: DTS Bandwidth

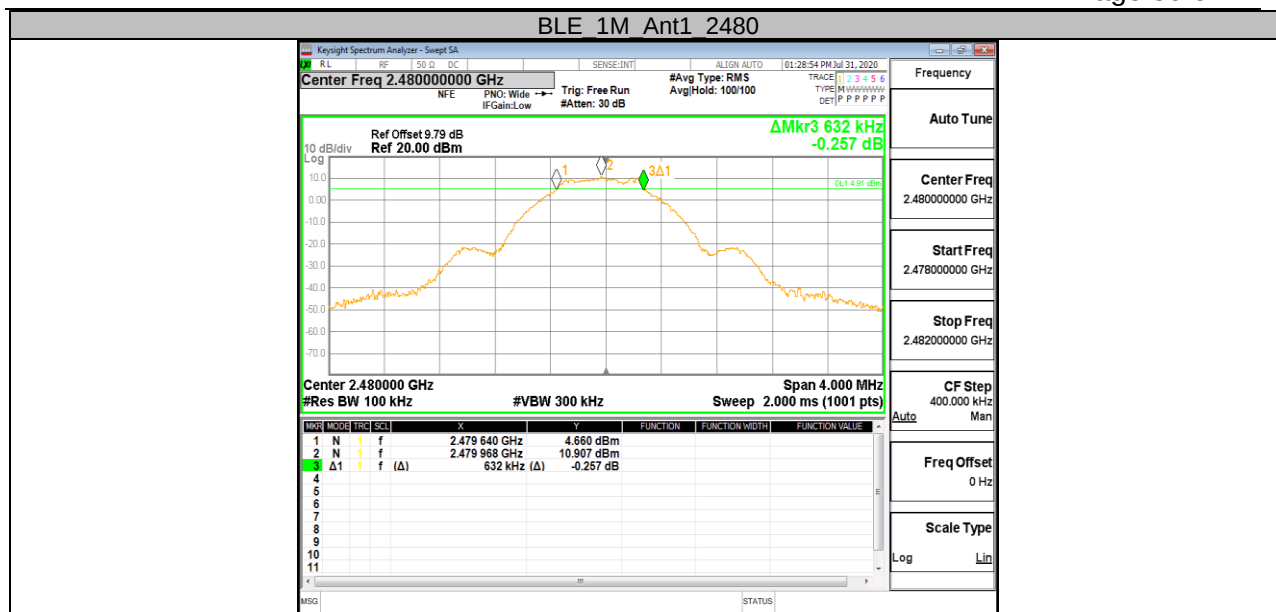
11.2.1. Test Result

Test Mode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.640	2401.648	2402.288	0.5	PASS
		2440	0.656	2439.636	2440.292	0.5	PASS
		2480	0.632	2479.640	2480.272	0.5	PASS



11.2.2. Test Graphs





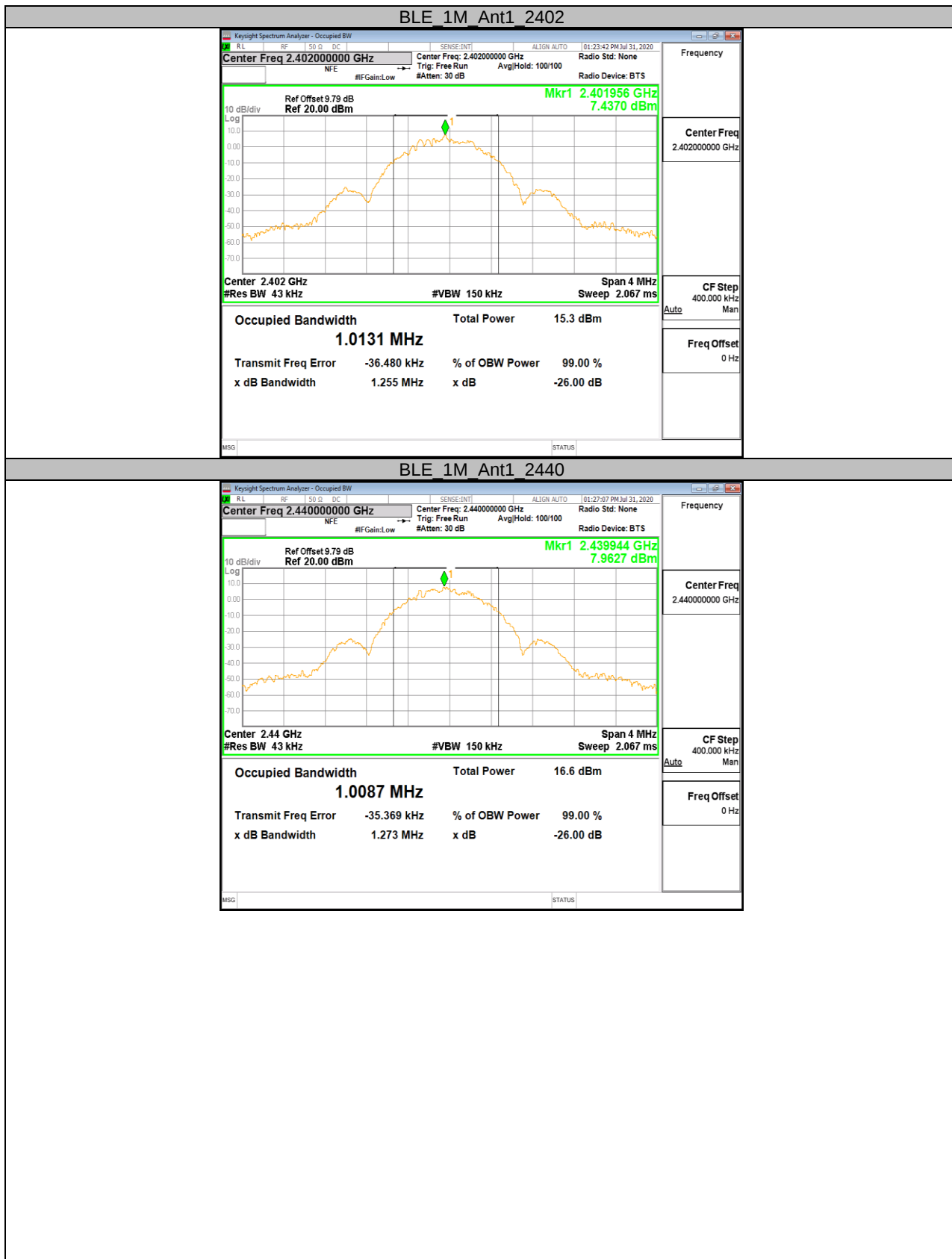


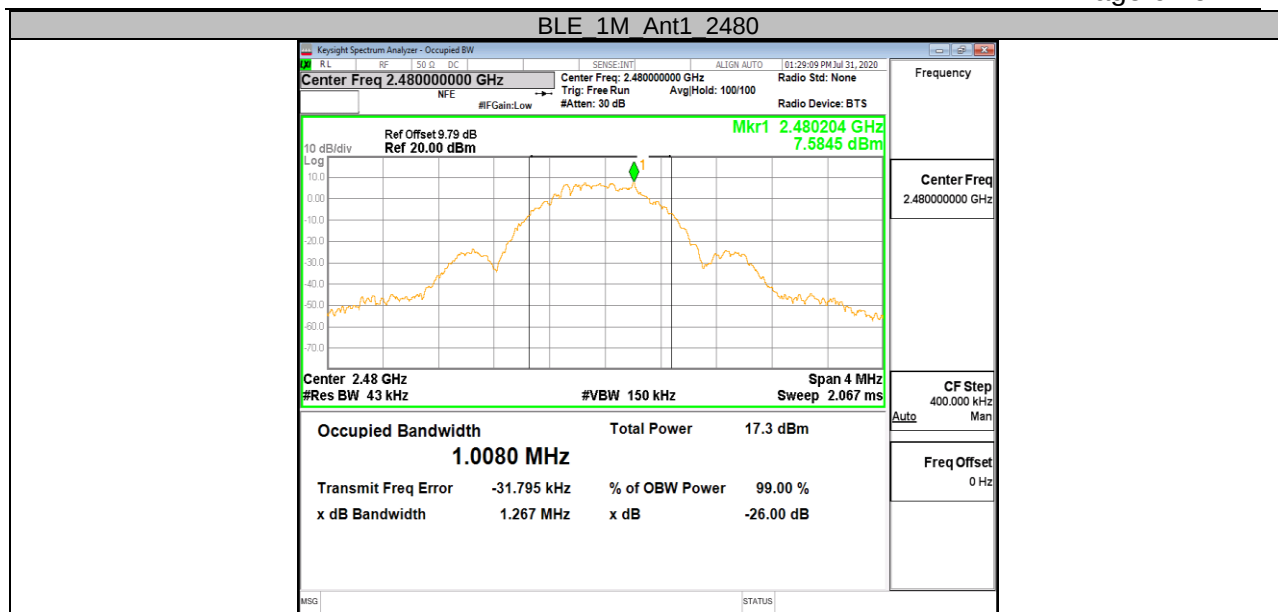
11.3. Appendix C: Occupied Channel Bandwidth

11.3.1. Test Result

Test Mode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	1.0131	2401.457	2402.470	---	PASS
		2440	1.0087	2439.460	2440.469	---	PASS
		2480	1.0080	2479.464	2480.472	---	PASS

11.3.2. Test Graphs







11.4. Appendix D: Maximum conducted output power

11.4.1. Test Result

Test Mode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	9.562	<=30	PASS
		2440	9.159	<=30	PASS
		2480	8.867	<=30	PASS



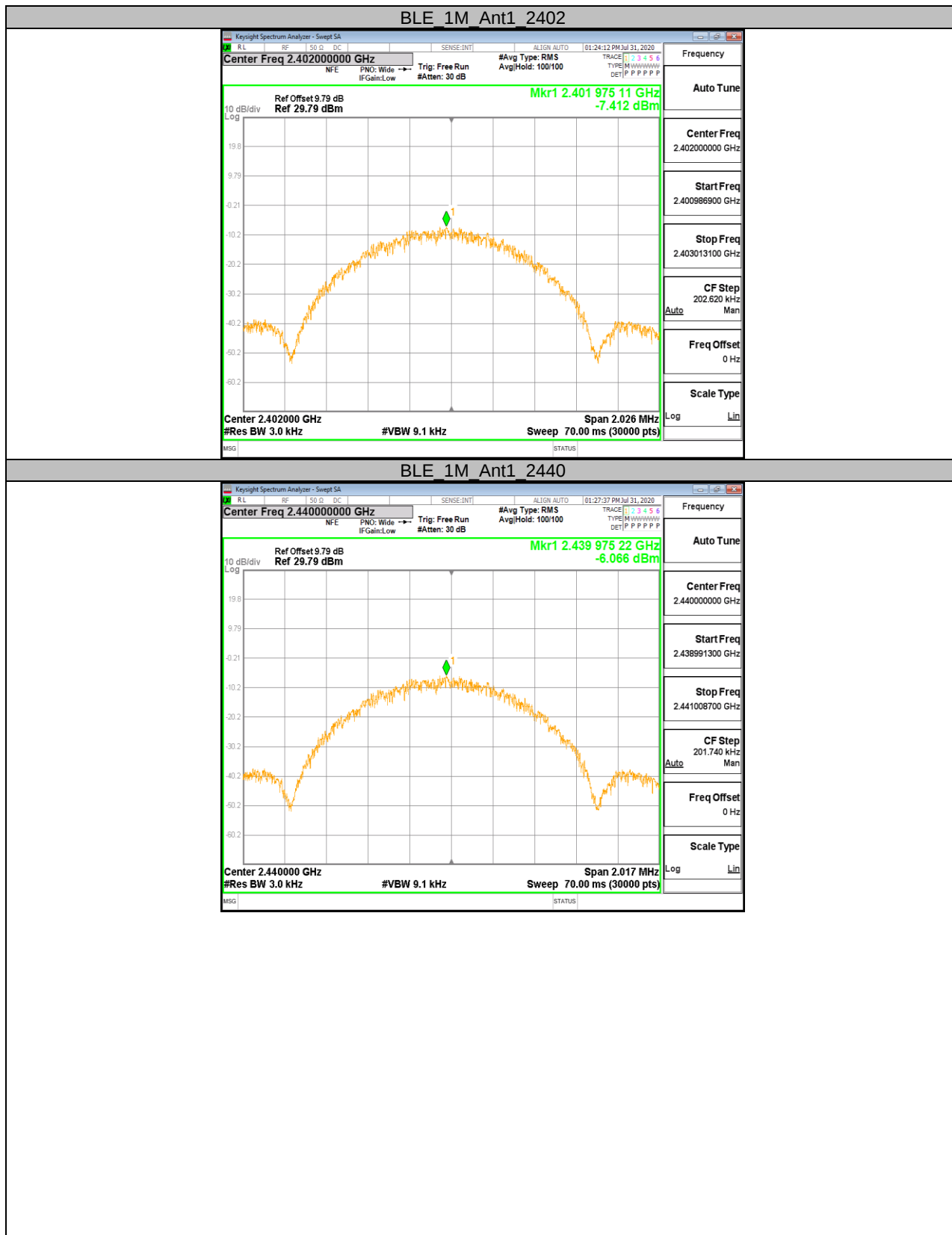
11.5. Appendix E: Maximum power spectral density

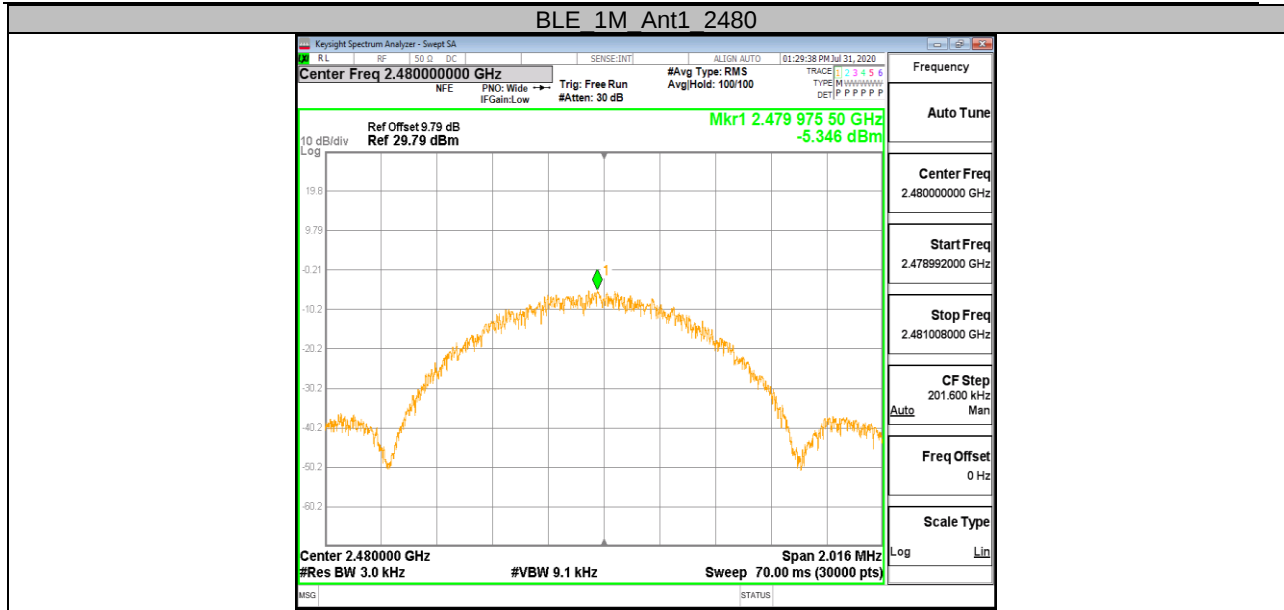
11.5.1. Test Result

Test Mode	Antenna	Channel	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-7.41	<=8	PASS
		2440	-6.07	<=8	PASS
		2480	-5.35	<=8	PASS



11.5.2. Test Graphs







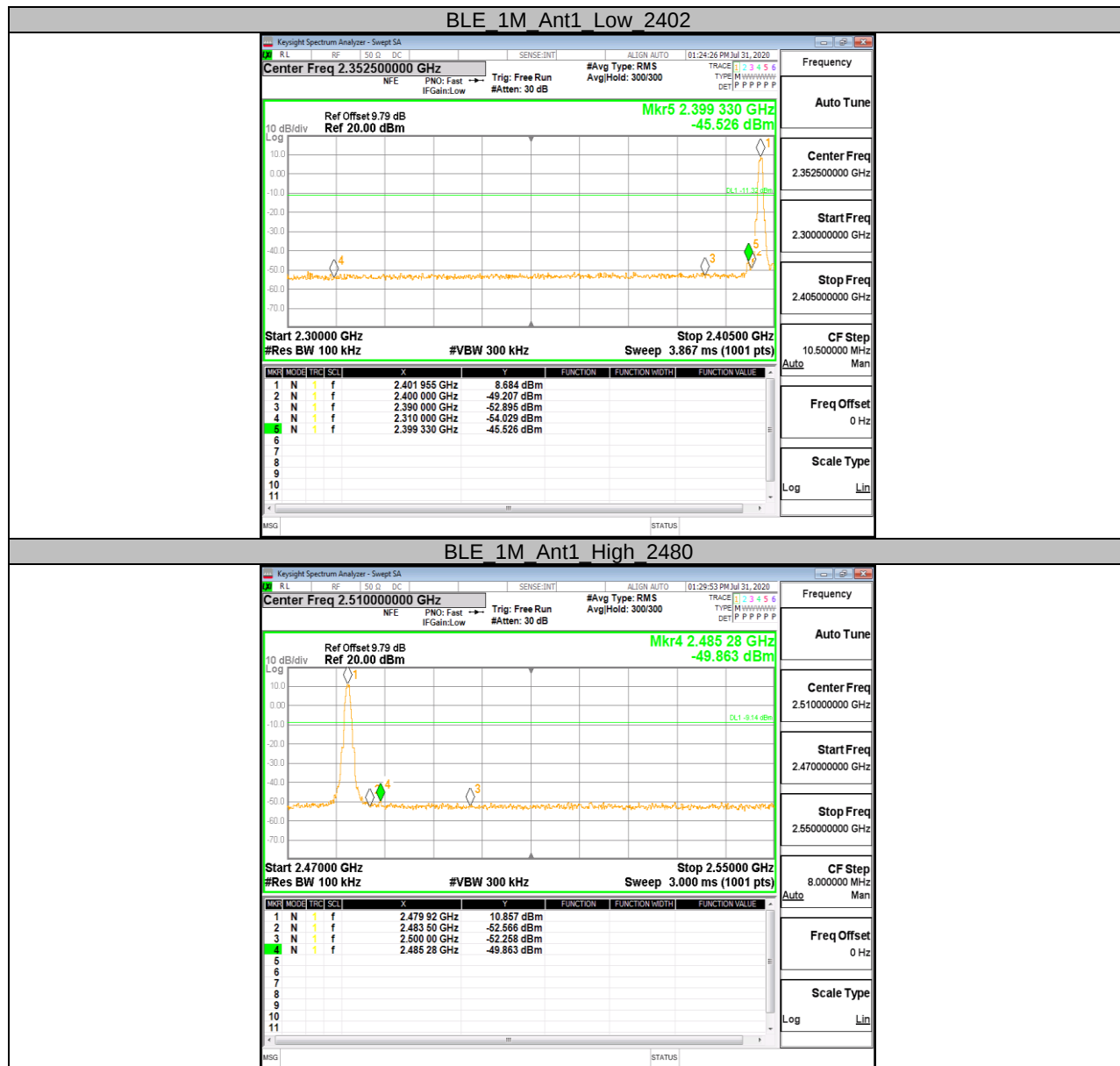
11.6. Appendix F: Band edge measurements

11.6.1. Test Result

Test Mode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	Low	2402	8.68	-45.53	<=-11.32	PASS
		High	2480	10.86	-49.86	<=-9.14	PASS



11.6.2. Test Graphs





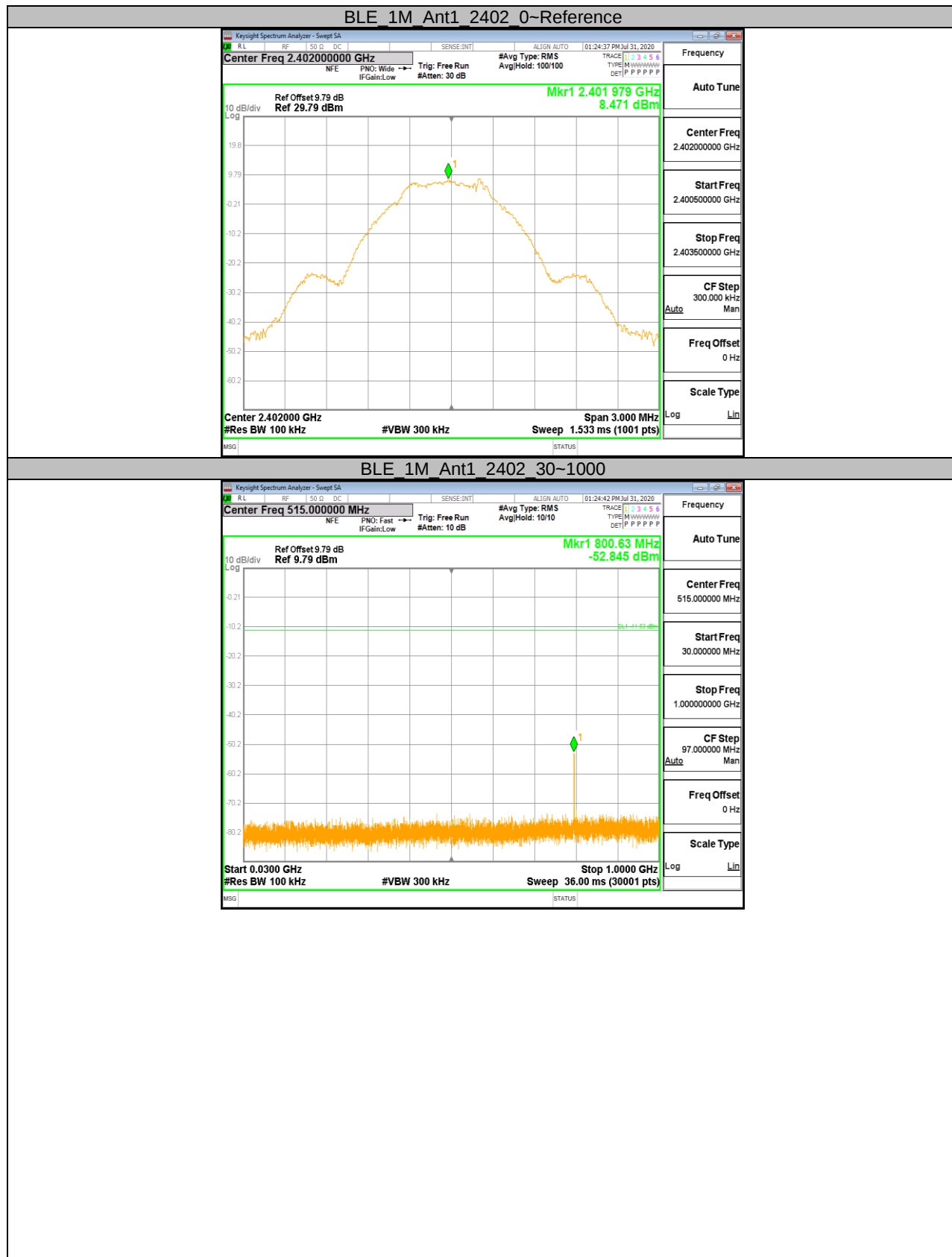
11.7. Appendix G: Conducted Spurious Emission

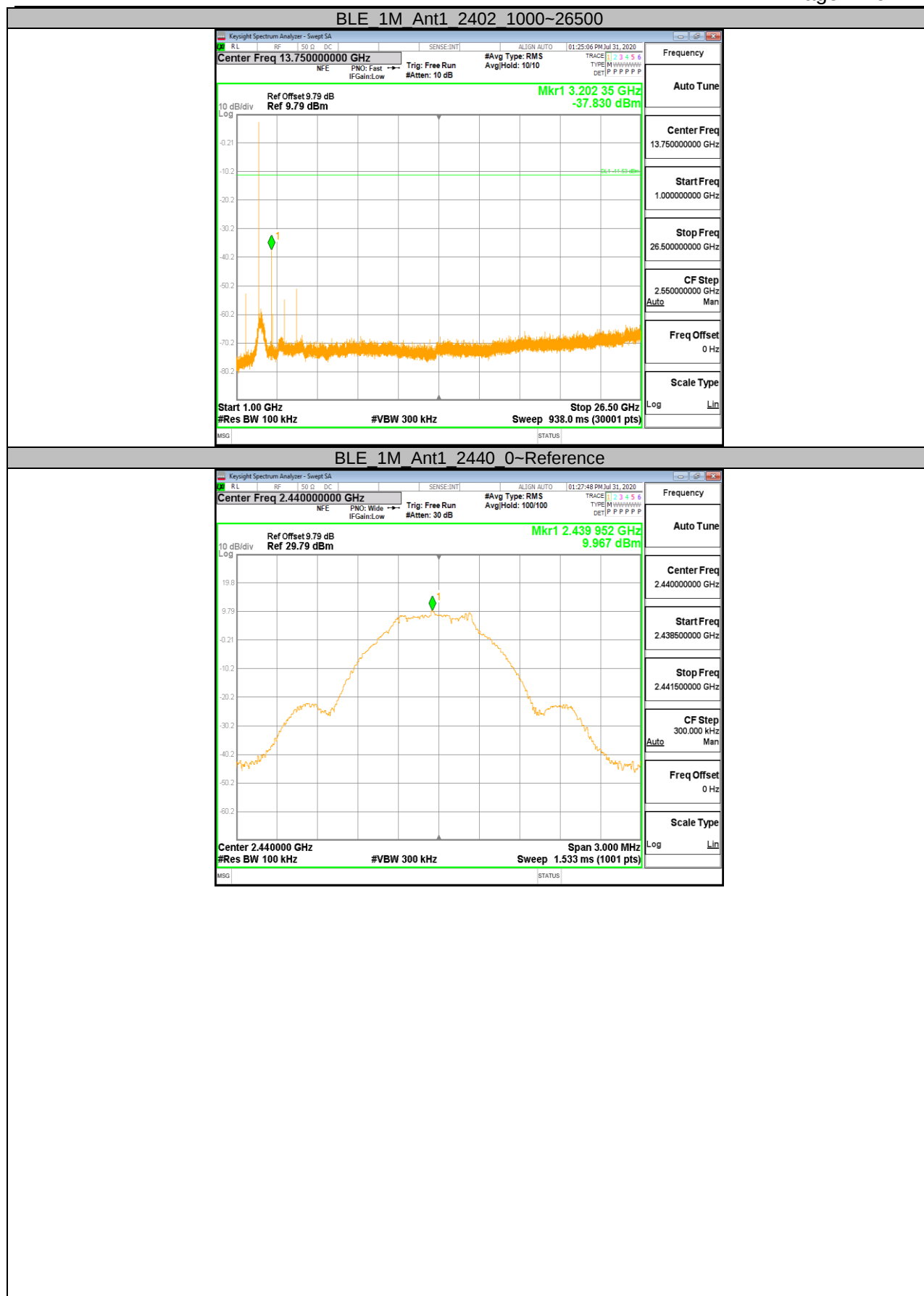
11.7.1. Test Result

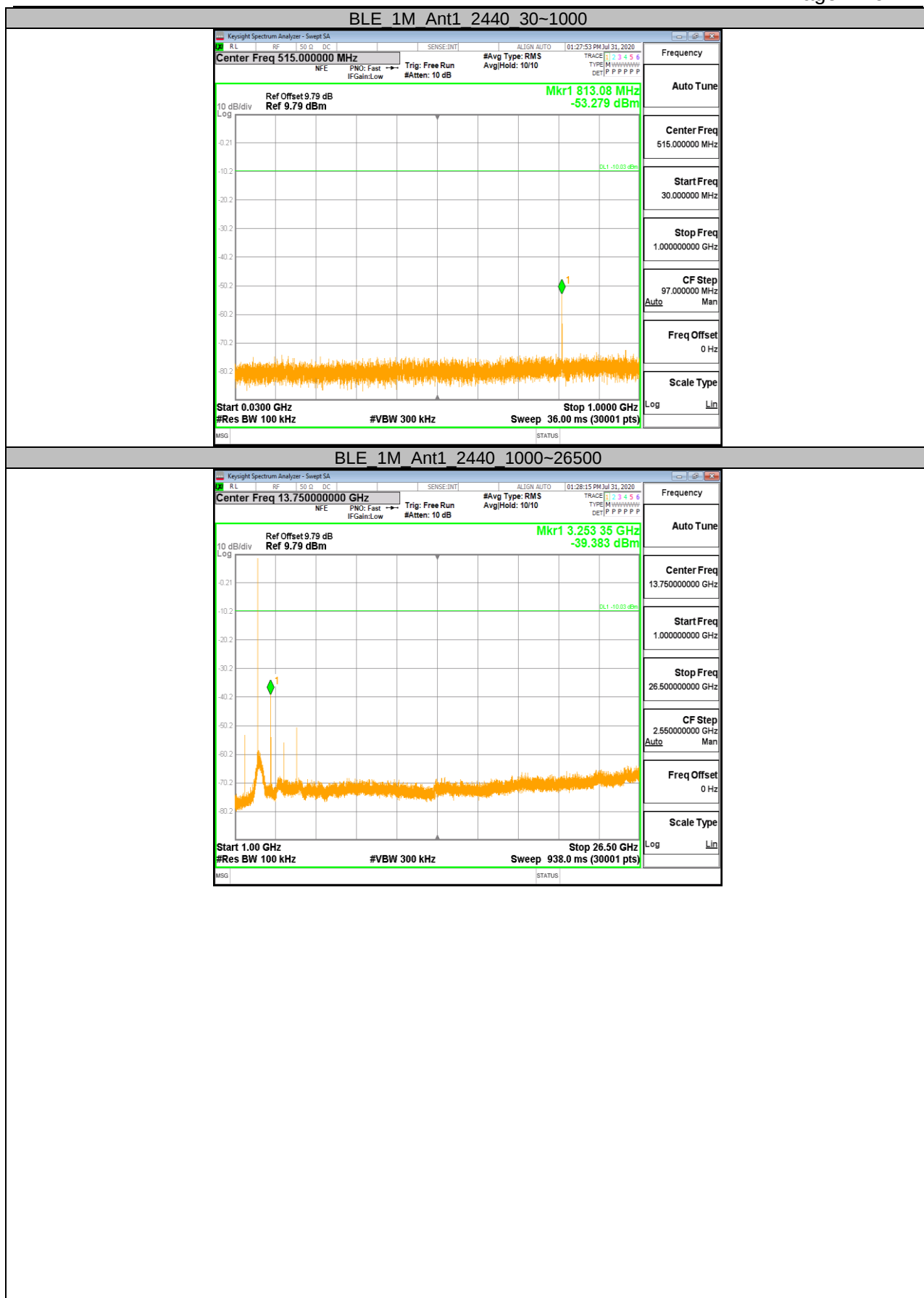
Test Mode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	Reference	8.47	8.47	---	PASS
			30~1000	---	-52.845	<=-11.529	PASS
			1000~26500	---	-37.83	<=-11.529	PASS
		2440	Reference	9.97	9.97	---	PASS
			30~1000	---	-53.279	<=-10.033	PASS
			1000~26500	---	-39.383	<=-10.033	PASS
		2480	Reference	10.56	10.56	---	PASS
			30~1000	---	-53.303	<=-9.442	PASS
			1000~26500	---	-39.784	<=-9.442	PASS

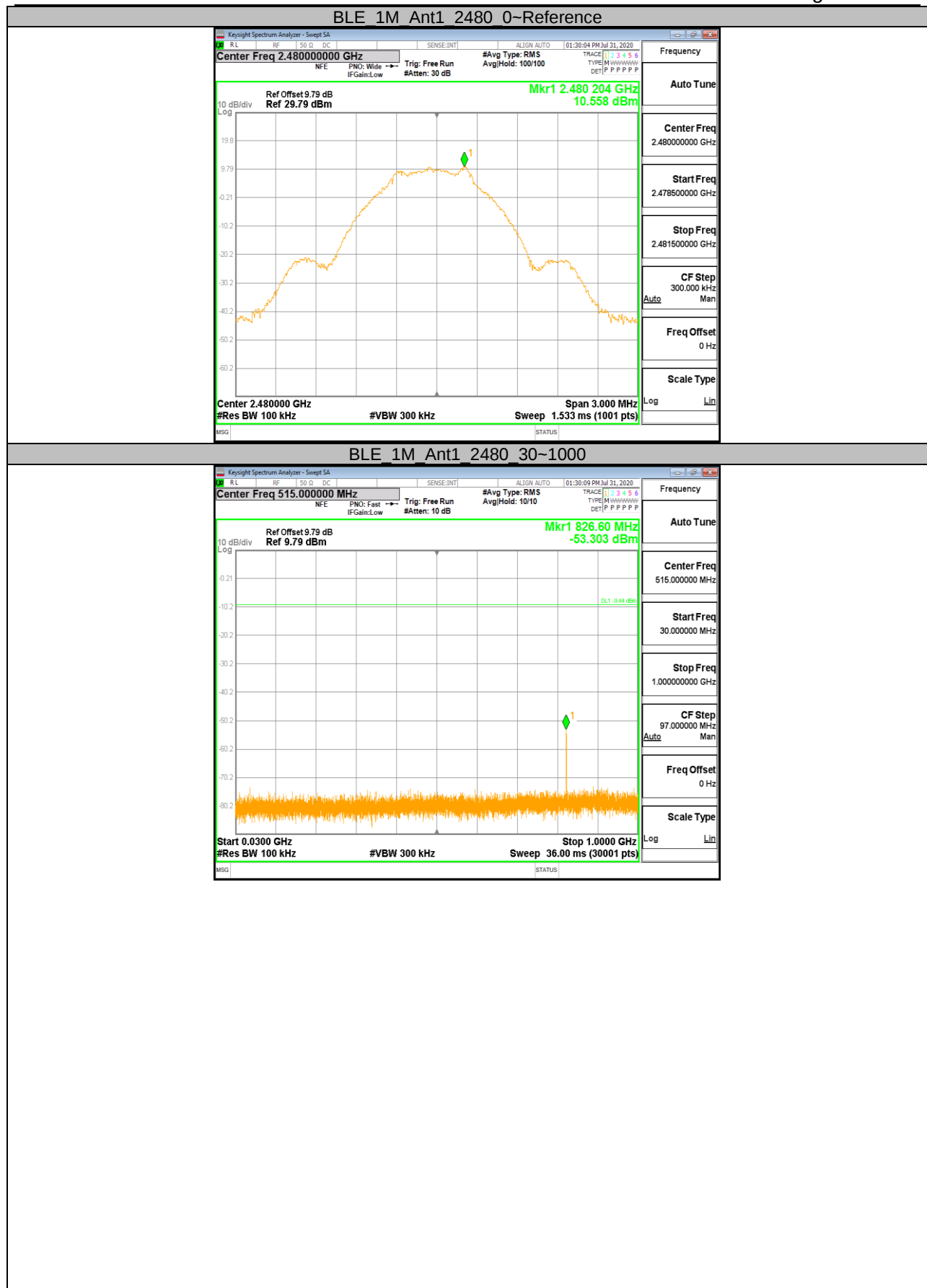


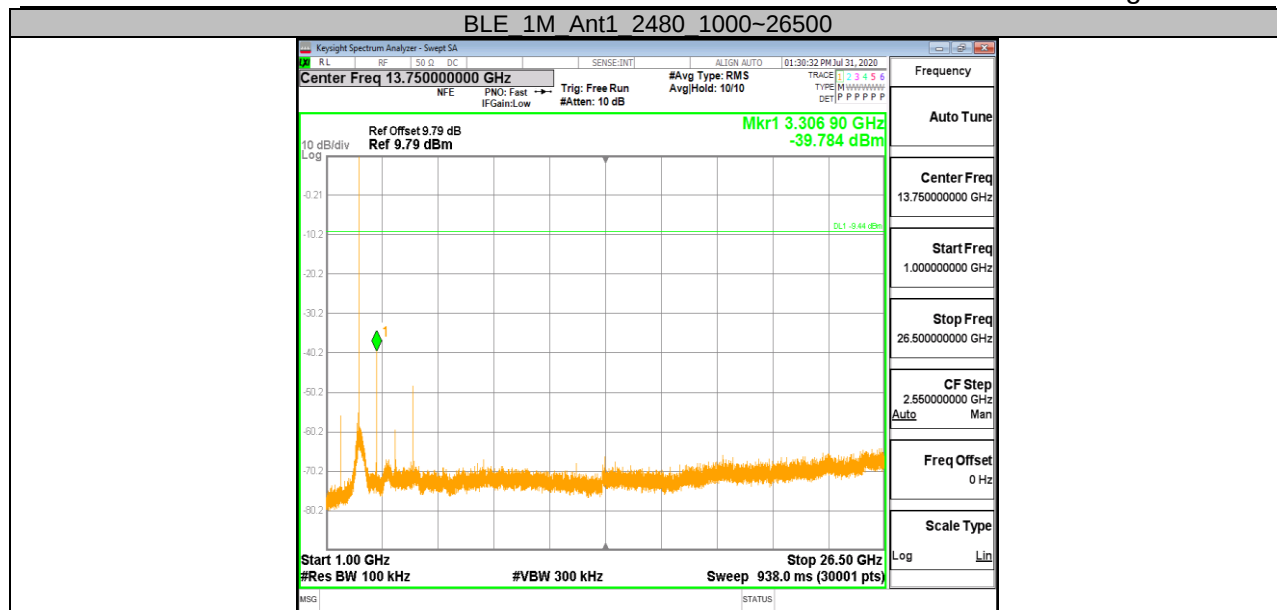
11.7.2. Test Graphs











END OF REPORT