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

CERTIFICATION TEST REPORT

For

WisePad 3S

MODEL NUMBER: WPS32

FCC ID: 2AB7X-WISEPAD3
ISED: 24228-WISEPAD3

REPORT NUMBER: 4789358177-2

ISSUE DATE: February 18, 2020

Prepared for

BBPOS International Limited
Suite 1903-04, Tower 2, Nina Tower, 8 Yeung Uk Road, Tsuen Wan, NT, Hong Kong

Prepared by

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Revision History

Rev.	Issue Date	Revisions	Revised By
V0	02/18/2020	Initial Issue	

Summary of Test Results			
Clause	**Test Items**	**FCC/ISED Rules**	**Test Results**
1	20dB Bandwidth and 99% Occupied Bandwidth	FCC 15.247 (a) (1) RSS-247 Clause 5.1 (a) RSS-Gen Clause 6.7	Pass
2	Conducted Output Power	FCC 15.247 (b) (1) RSS-247 Clause 5.1 (b)	Pass
3	Carrier Hopping Channel Separation	FCC 15.247 (a) (1) RSS-247 Clause 5.1 (b)	Pass
4	Number of Hopping Frequency	15.247 (a) (1) III RSS-247 Clause 5.1 (d)	Pass
5	Time of Occupancy (Dwell Time)	15.247 (a) (1) III RSS-247 Clause 5.1 (d)	Pass
6	Conducted Bandedge	FCC 15.247 (d) RSS-247 Clause 5.5	Pass
7	Radiated Bandedge and Spurious	FCC 15.247 (d) FCC 15.209 FCC 15.205 RSS-247 Clause 5.5 RSS-GEN Clause 8.9 RSS-GEN Clause 8.10	Pass
8	Conducted Emission Test For AC Power Port	FCC 15.207 RSS-GEN Clause 8.8	Pass
9	Antenna Requirement	FCC 15.203 RSS-GEN Clause 6.8	Pass
Note: This test report is only published to and used by the applicant, and it is not for evidence purpose in China.			

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1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name:	BBPOS International Limited
Address:	Suite 1903-04, Tower 2, Nina Tower, 8 Yeung Uk Road, Tsuen Wan, NT, Hong Kong

Manufacturer Information

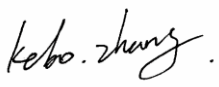
Company Name:	BBPOS International Limited
Address:	Suite 1903-04, Tower 2, Nina Tower, 8 Yeung Uk Road, Tsuen Wan, NT, Hong Kong

EUT Description

Product Name	WisePad 3S
Model Name	WPS32
Series Product Name	WisePad 3
Series Model	WPC32
Model Difference	See section 5.1 of this report for detail.
Brand	BBPOS
Sample Status	Normal
Sample ID	2892046
Sample Received date	January 10, 2020
Date Tested	January 13-February 18, 2020

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
Engineer Project Associate

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. **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 recognized 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-18Gz)
	5.23dB (18GHz-26Gz)
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

Product Name	WisePad 3S	
Model	WPS32	
Series Product Name	WisePad 3	
Series Model	WPC32	
Model Difference	The BT/BLE and NFC all have the same circuit diagram, PCB layout, components and component layout. WisePad 3S is identical to WisePad 3 except for enclosure and function of card slot. The WisePad3S includes the MSR card slot and MSR circuitry. And there is a mechanical difference in that the enclosure has the card slot in the WisePad 3S that the WisePad 3 does not have. About the more detail, please refer to the model declaration letter.	
Product Description	Operation Frequency	2402 MHz ~ 2480 MHz
	Modulation Type	Data Rate
	GFSK	1Mbps
Supply Voltage	DC 3.7V	
Bluetooth version	4.2BR	

5.2. MAXIMUM OUTPUT POWER

Bluetooth Mode	Frequency (MHz)	Channel Number	Max Output Power (dBm)	EIRP (dBm)
GFSK	2402-2480	0-78[79]	-2.495	-1.945

5.3. PACKET TYPE CONFIGURATION

Test Mode	Packet Type	Setting(Packet Length)
GFSK	DH1	27
	DH3	183
	DH5	339

5.4. CHANNEL LIST

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	20	2422	40	2442	60	2462
01	2403	21	2423	41	2443	61	2463
02	2404	22	2424	42	2444	62	2464
03	2405	23	2425	43	2445	63	2465
04	2406	24	2426	44	2446	64	2466
05	2407	25	2427	45	2447	65	2467
06	2408	26	2428	46	2448	66	2468
07	2409	27	2429	47	2449	67	2469
08	2410	28	2430	48	2450	68	2470
09	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461	\	\

5.5. TEST CHANNEL CONFIGURATION

Test Mode	Test Channel Number	Test Channel
GFSK	CH 0, CH 39, CH 78/ Low, Middle, High	2402MHz, 2441MHz, 2480MHz

5.6. THE WORSE CASE POWER SETTING PARAMETER

The Worse Case Power Setting Parameter under 2400 ~ 2483.5MHz Band				
Test Software		FCC TestTool		
Modulation Type	Transmit Antenna Number	Test Software Setting Value		
		CH 00	CH 39	CH 78
GFSK	1	Default	Default	Default

5.7. DESCRIPTION OF AVAILABLE ANTENNAS

Antenna	Frequency (MHz)	Antenna Type	MAX Antenna Gain (dBi)
1	2402-2480	meandered printed inverted-F antenna	0.55

Test Mode	Transmit and Receive Mode	Description
GFSK	1TX, 1RX	Chain 1 can be used as transmitting/receiving antenna.

5.8. WORST-CASE CONFIGURATIONS

Bluetooth Mode	Modulation Technology	Modulation Type	Data Rate (Mbps)
BR	FHSS	GFSK	1Mbit/s

Note: 1.Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates.

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	DC 3.7V
	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	P/N
1	Laptop	ThinkPad	T460S	SL10K24796 JS
2	UART	/	/	/

I/O CABLES

Cable No	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
1	USB	/	/	1.0	/

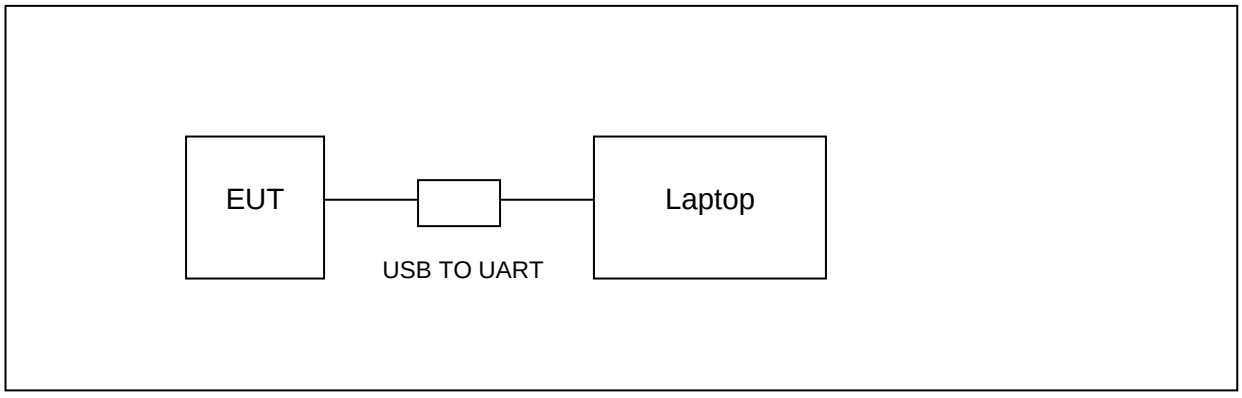
ACCESSORY

Item	Accessory	Brand Name	Model Name	Description
1	/	/	/	/

TEST SETUP

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

SETUP DIAGRAM FOR TESTS



Note: The two models(WisePad 3S and WisePad 3) have been considered, so the test will show the worst case WisePad 3S model.

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.05,2020
☑	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-305-00067	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.05,2020
☑	Power Meter	Keysight	N1911A	MY55416024	Dec.06,2019	Dec.05,2020
☑	Power Sensor	Keysight	U2021XA	MY58100022	Dec.06,2019	Dec.05,2020

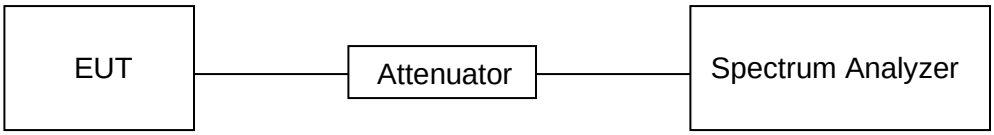
7. ANTENNA PORT TEST RESULTS

7.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only

TEST SETUP



TEST ENVIRONMENT

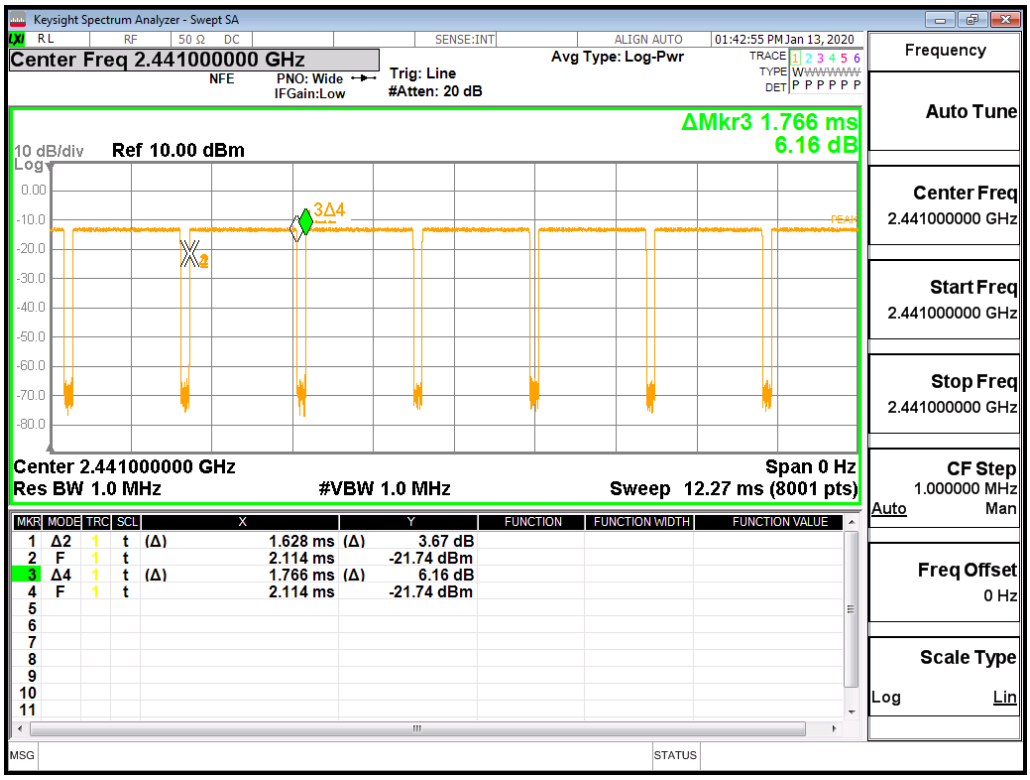
Temperature	25.2°C	Relative Humidity	58%
Atmosphere Pressure	101kPa	Test Voltage	DC 3.7V

RESULTS

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)
GFSK	1.628	1.766	0.922	92.2	0.353	0.61	1

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.

DH5 ON TIME AND DUTY CYCLE MID CH



7.2. 20 dB OCCUPIED 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) (1) RSS-247 Clause 5.1 (a)	20dB Occupied Bandwidth	N/A	2400-2483.5
ISED RSS-Gen Clause 6.7	99% Occupied Bandwidth	N/A	2400-2483.5

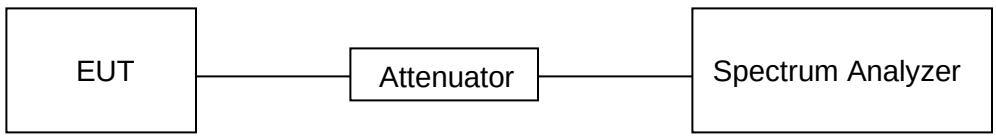
TEST PROCEDURE

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 20dB Occupied Bandwidth: 1% to 5% of the 20 dB bandwidth For 99% Occupied Bandwidth: 1% to 5% of the occupied bandwidth
VBW	For 20dB Occupied Bandwidth: approximately 3×RBW For 99% Occupied Bandwidth: ≥ 3×RBW
Span	Between 2 times and 5 times the 20dB OBW. Between 1.5 times and 5.0 times the 99% OBW.
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 20 dB and 99% relative to the maximum level measured in the fundamental emission.

TEST SETUP



TEST ENVIRONMENT

Temperature	25.2°C	Relative Humidity	58%
Atmosphere Pressure	101kPa	Test Voltage	DC 3.7V

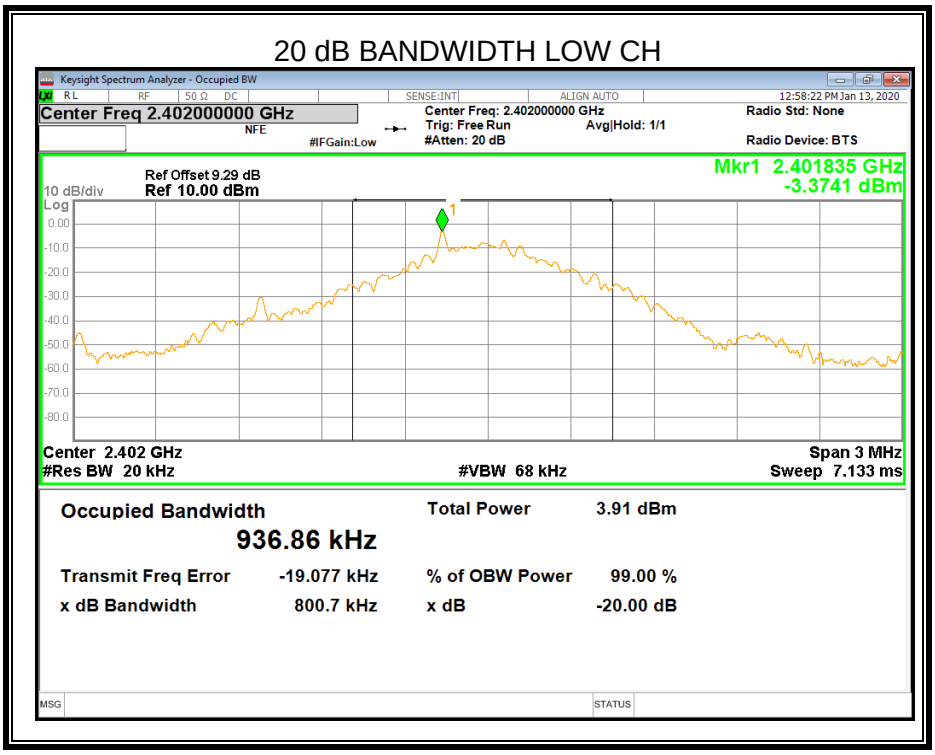
RESULTS

7.2.1. GFSK MODE

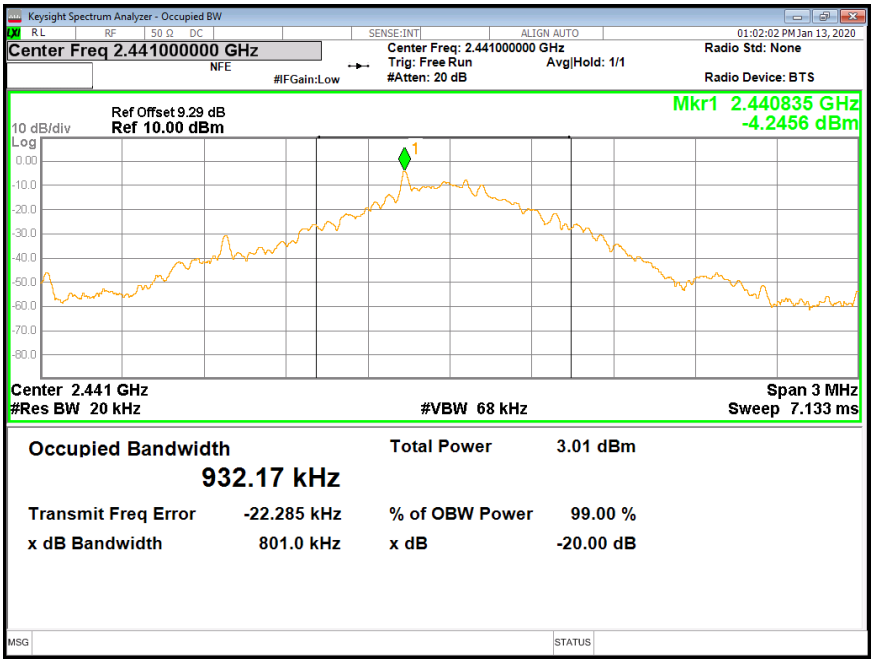
Channel	Frequency (MHz)	20dB Occupied bandwidth (MHz)	99% Occupied bandwidth (MHz)	Result
Low	2402	0.8007	0.93630	PASS
Middle	2441	0.8010	0.93065	PASS
High	2480	0.8003	0.92309	PASS

Test Graph

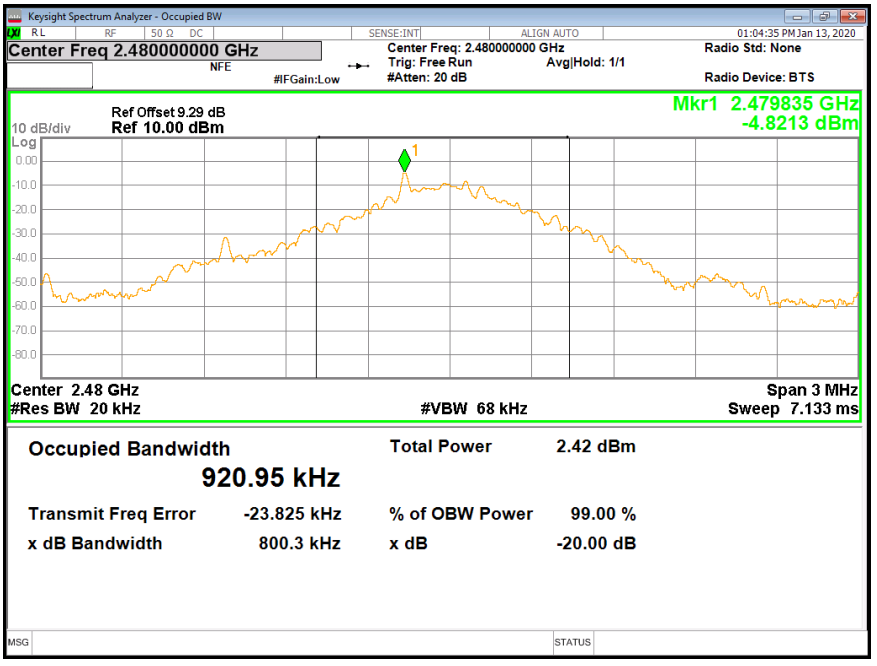
20 dB BANDWIDTH LOW CH



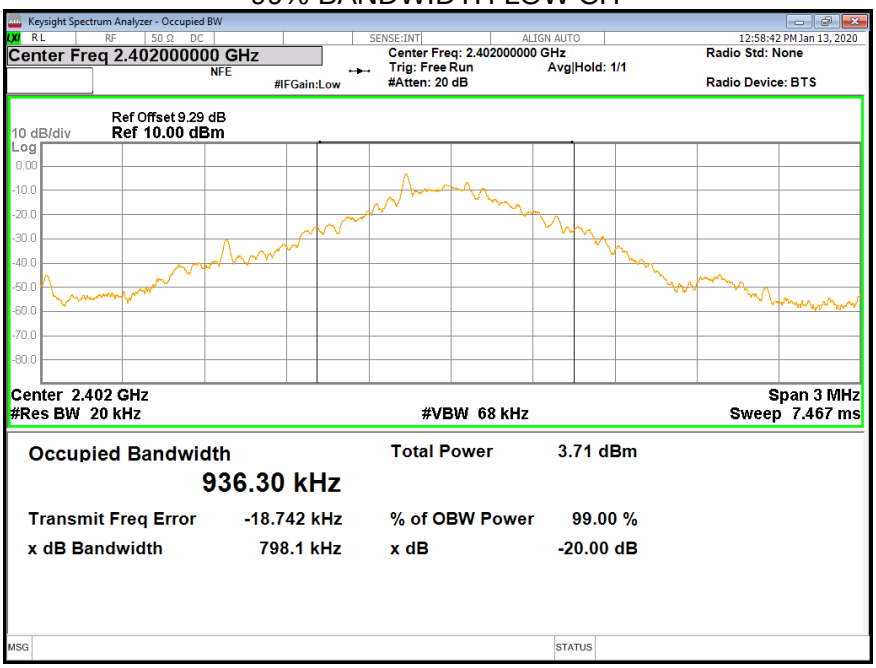
20 dB BANDWIDTH MID CH



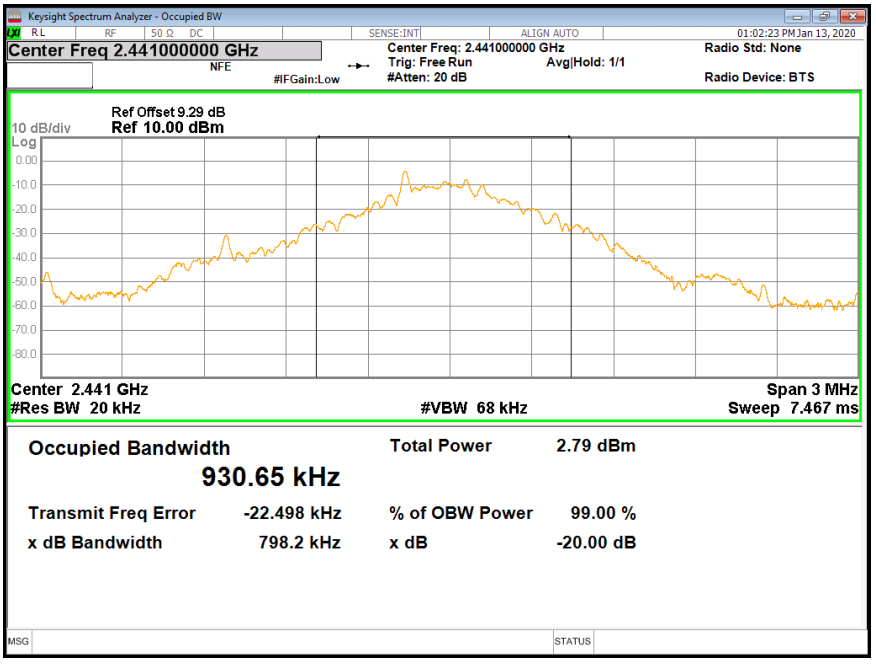
20 dB BANDWIDTH HIGH CH



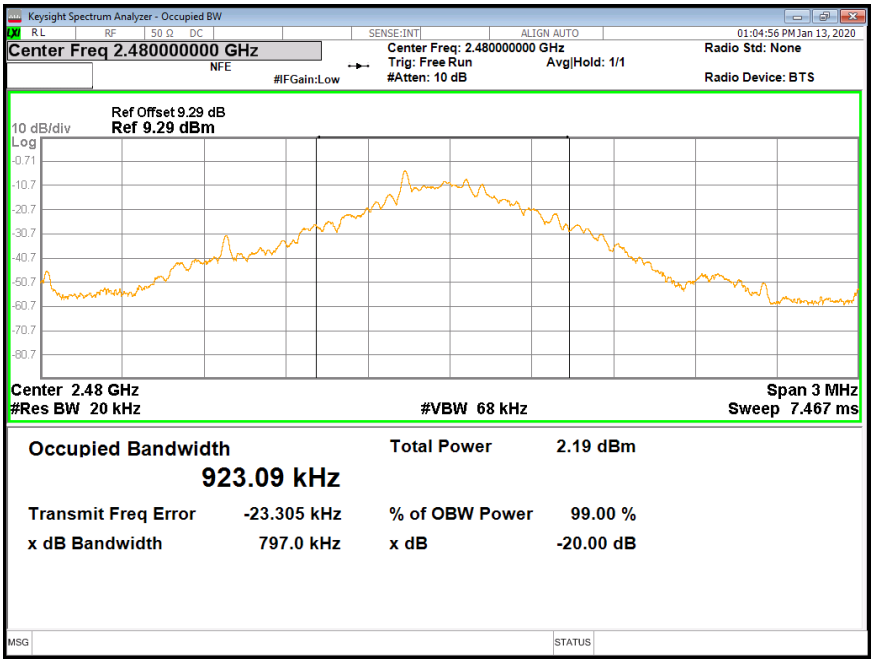
99% BANDWIDTH LOW CH



99% BANDWIDTH MID CH



99% BANDWIDTH HIGH CH



7.3. CONDUCTED OUTPUT POWER

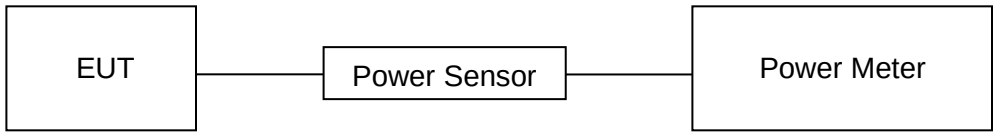
LIMITS

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) (1) ISED RSS-247 Clause 5.4 (b)	Peak Conducted Output Power	Hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel : 1 watt or 30dBm; Hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel : 125 mW or 21dBm	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	25.2°C	Relative Humidity	58%
Atmosphere Pressure	101kPa	Test Voltage	DC 3.7V

RESULTS

7.3.1. GFSK MODE

Channel	Frequency	Maximum Conducted Output Power(PK)	EIRP	Limit	Result
	(MHz)	(dBm)	(dBm)	(dBm)	
Low	2402	-2.495	-1.945	30	Pass
Middle	2441	-3.333	-2.783	30	Pass
High	2480	-3.890	-3.340	30	Pass

Note: EIRP= Maximum Conducted Output Power + Antenna Gain

Note: The channel separation is 1MHz and the 20dB Bandwidth is less than 1MHz.

7.4. CARRIER HOPPING CHANNEL SEPARATION

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 (a) (1) ISED RSS-247 Clause 5.1 (b)	Carrier Hopping Channel Separation	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel.	2400-2483.5

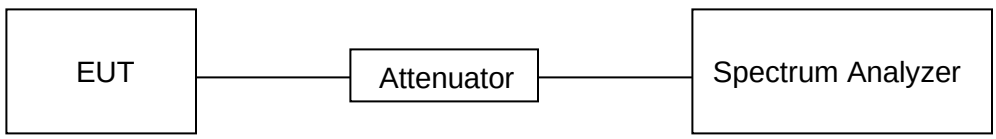
TEST PROCEDURE

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

Center Frequency	The center frequency of the channel under test
Span	wide enough to capture the peaks of two adjacent channels
Detector	Peak
RBW	Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
VBW	≥RBW
Trace	Max hold
Sweep time	Auto couple

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.
Compliance of an EUT with the appropriate regulatory limit shall be determined.
A plot of the data shall be included in the test report.

TEST SETUP



TEST ENVIRONMENT

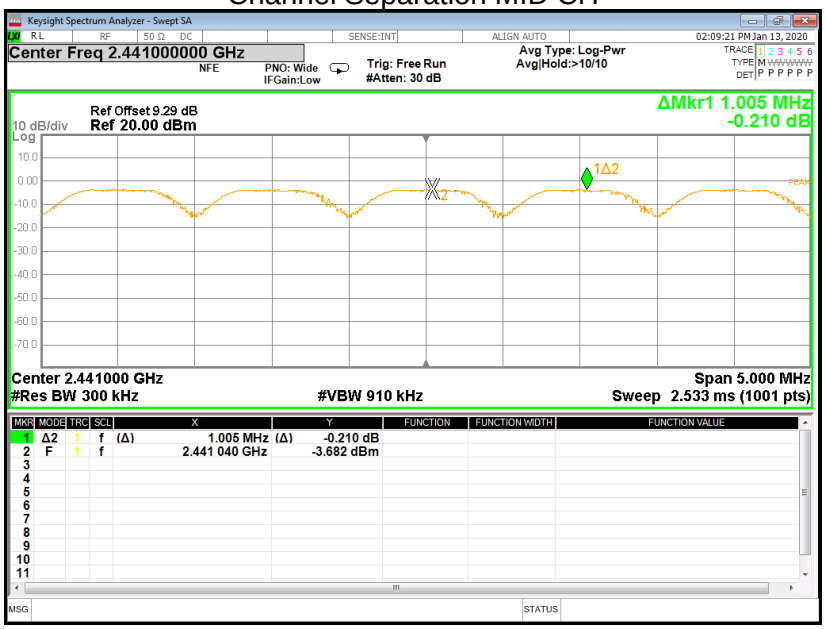
Temperature	25.2°C	Relative Humidity	58%
Atmosphere Pressure	101kPa	Test Voltage	DC 3.7V

RESULTS

7.4.1. GFSK MODE

Channel	Carrier Hopping Channel Separation (MHz)	Limit (MHz)	Result
Middle	1.005	≥ 20 dB Bandwidth Of The Hopping Channel	PASS

Channel Separation MID CH



Note: For 20 dB Bandwidth of The Hopping Channel, please refer to clause 7.2.1.

7.5. NUMBER OF HOPPING FREQUENCY

LIMITS

CFR 47 FCC Part15 (15.247) , Subpart C ISED RSS-247 ISSUE 2		
Section	Test Item	Limit
CFR 47 15.247 (a) (1) III ISED RSS-247 Clause 5.1 (d)	Number of Hopping Frequency	at least 15 hopping channels

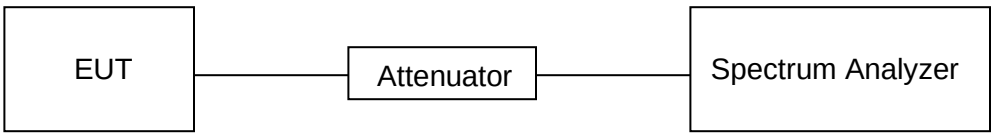
TEST PROCEDURE

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

Detector	Peak
RBW	To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
VBW	≥RBW
Span	The frequency band of operation
Trace	Max hold
Sweep time	Auto couple

Set EUT to transmit maximum output power and switch on frequency hopping function. then set enough count time (larger than 5000 times) to get all the hopping frequency channel displayed on the screen of spectrum analyzer.
Count the quantity of peaks to get the number of hopping channels.
FHSS Mode: 79 Channels observed.
AFHSS Mode: 20 Channels declared.

TEST SETUP



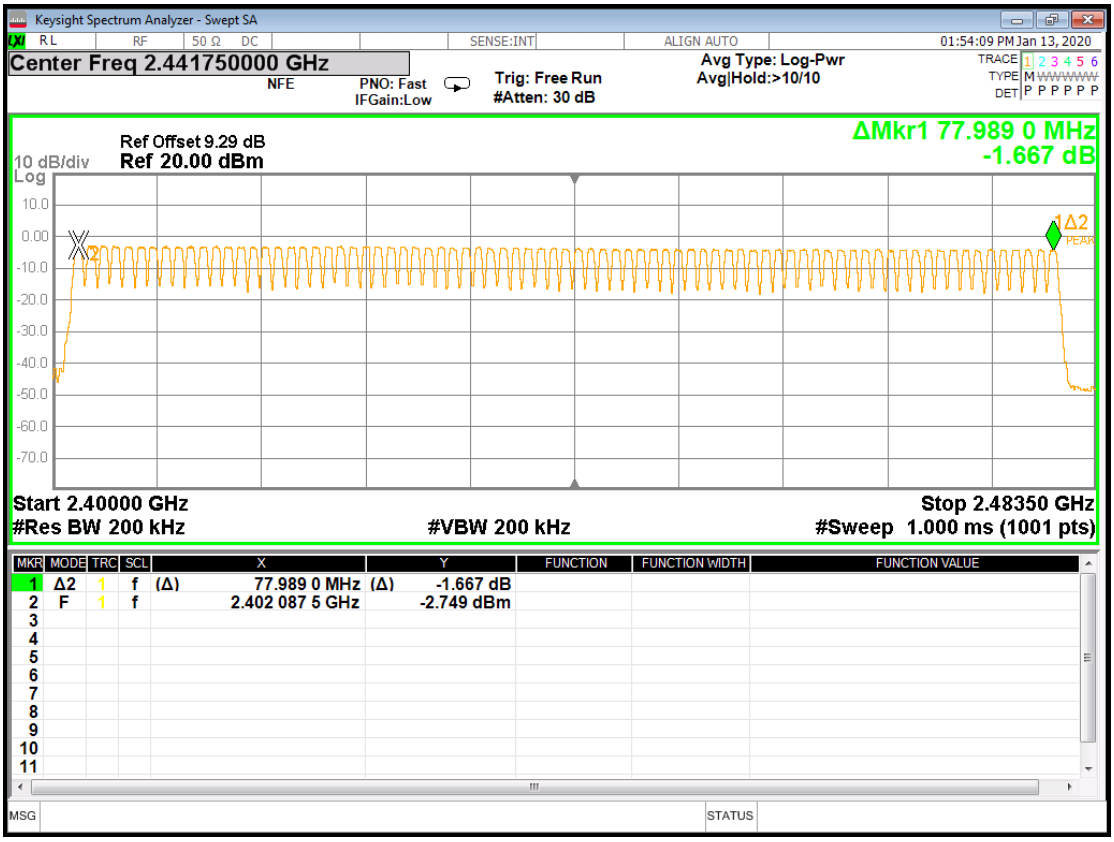
TEST ENVIRONMENT

Temperature	25.2°C	Relative Humidity	58%
Atmosphere Pressure	101kPa	Test Voltage	DC 3.7V

RESULTS

7.5.1. GFSK MODE

Hopping numbers	Limit	Results
79	>=15	Pass



7.6. TIME OF OCCUPANCY (DWELL TIME)

LIMITS

CFR 47 FCC Part15 (15.247) , Subpart C ISED RSS-247 ISSUE 2		
Section	Test Item	Limit
CFR 47 15.247 (a) (1) III ISED RSS-247 Clause 5.1 (d)	Time of Occupancy (Dwell Time)	The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds, multiplied by the number of hopping channels employed.

TEST PROCEDURE

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

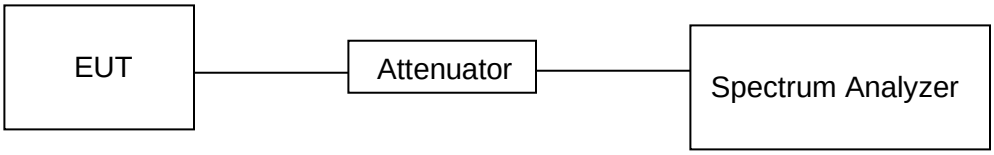
Center Frequency	The center frequency of the channel under test
Detector	Average
RBW	1 MHz
VBW	≥RBW
Span	zero span
Trace	Clear Write
Sweep time	As necessary to capture the entire dwell time per hopping channel

a. The transmitter output (antenna port) was connected to the spectrum analyzer
b. Set RBW of spectrum analyzer to 1MHz and VBW to 1MHz.
c. Use a video trigger with the trigger level set to enable triggering only on full pulses.
d. Sweep Time is more than once pulse time.
e. Set the center frequency on any frequency would be measure and set the frequency span to zero span.
f. Measure the maximum time duration of one single pulse.
g. Set the EUT for DH5, DH3 and DH1 packet transmitting.
h. Measure the maximum time duration of one single pulse.
A Period Time = (channel number)*0.4

For FHSS Mode (79 Channel):
DH1 Time Slot: Reading * (1600/2)*31.6/(channel number)
DH3 Time Slot: Reading * (1600/4)*31.6/(channel number)
DH5 Time Slot: Reading * (1600/6)*31.6/(channel number)

For AFHSS Mode (20 Channel):
DH1 Time Slot: Reading * (800/2)*8/(channel number)
DH3 Time Slot: Reading * (800/4)*8/(channel number)
DH5 Time Slot: Reading * (800/6)*8/(channel number)

TEST SETUP



TEST ENVIRONMENT

Temperature	25.2°C	Relative Humidity	58%
Atmosphere Pressure	101kPa	Test Voltage	DC 3.7V

RESULTS

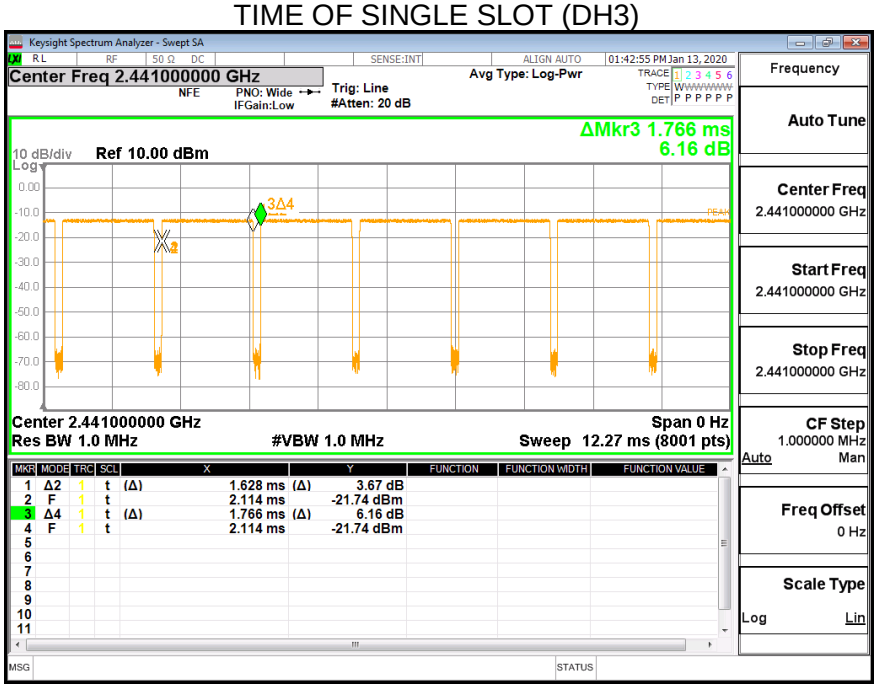
7.6.1. GFSK MODE

FHSS Mode				
Packet	**Channel**	**Burst Width [ms/hop/ch]**	**Dwell Time [s]**	**Results**
DH1	MCH	0.433	0.1386	PASS
DH3	MCH	1.628	0.2605	PASS
DH5	MCH	2.827	0.3015	PASS
AFHSS Mode				
DH1	MCH	0.433	0.0693	PASS
DH3	MCH	1.628	0.1302	PASS
DH5	MCH	2.827	0.1508	PASS

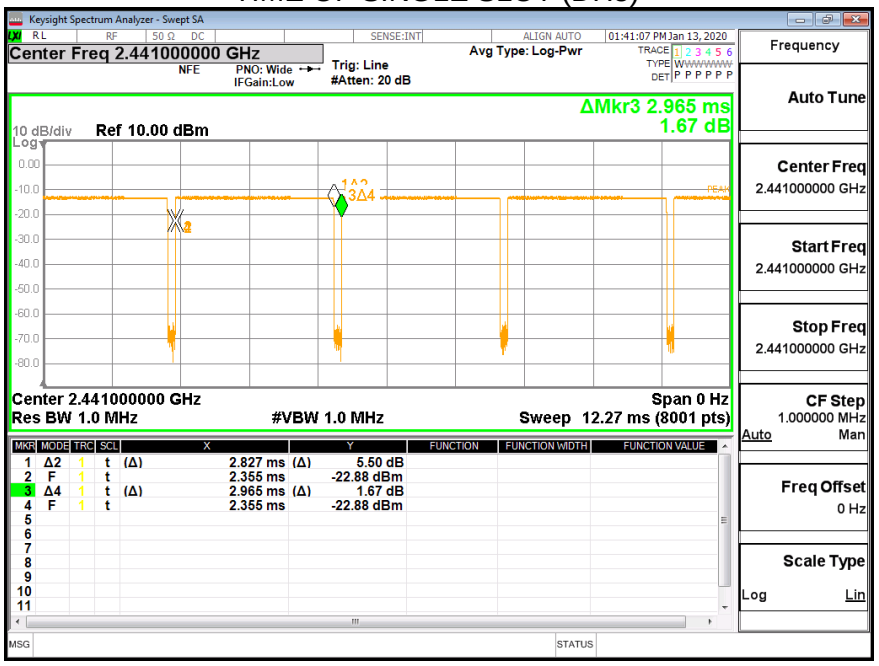
Test Graph

TIME OF SINGLE SLOT (DH1)

TIME OF SINGLE SLOT (DH3)



TIME OF SINGLE SLOT (DH5)



7.7. CONDUCTED SPURIOUS EMISSION

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 Spurious Emission	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

Please refer to the ANSI C63.10 section 6.10.

For Bandedge use the following settings:

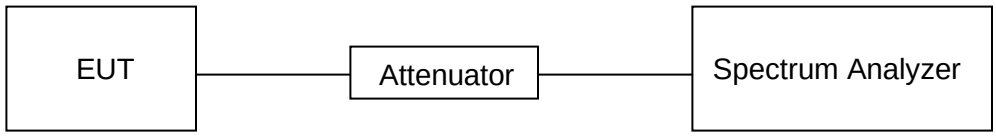
Detector	Peak
RBW	100kHz
VBW	300kHz
Span	wide enough to fully capture the emission being measured
Trace	Max hold
Sweep time	Auto couple.

For Spurious Emission use the following settings:

Detector	Peak
RBW	100kHz
VBW	300kHz
Span	wide enough to fully capture the emission being measured
Trace	Max hold
Sweep time	Auto couple.

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

TEST SETUP



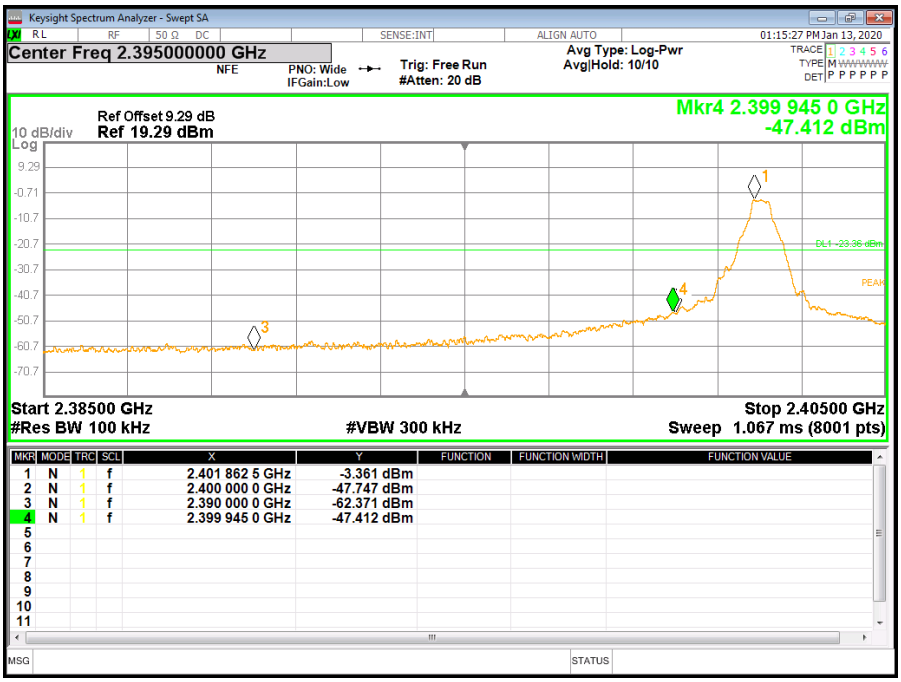
TEST ENVIRONMENT

Temperature	25.2°C	Relative Humidity	58%
Atmosphere Pressure	101kPa	Test Voltage	DC 3.7V

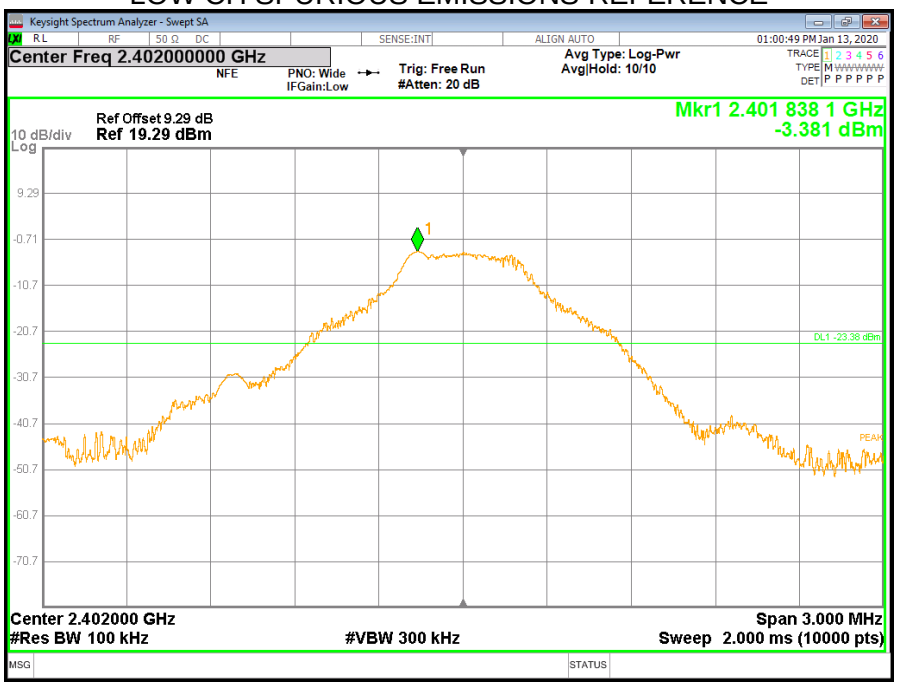
RESULTS

7.7.1. GFSK MODE

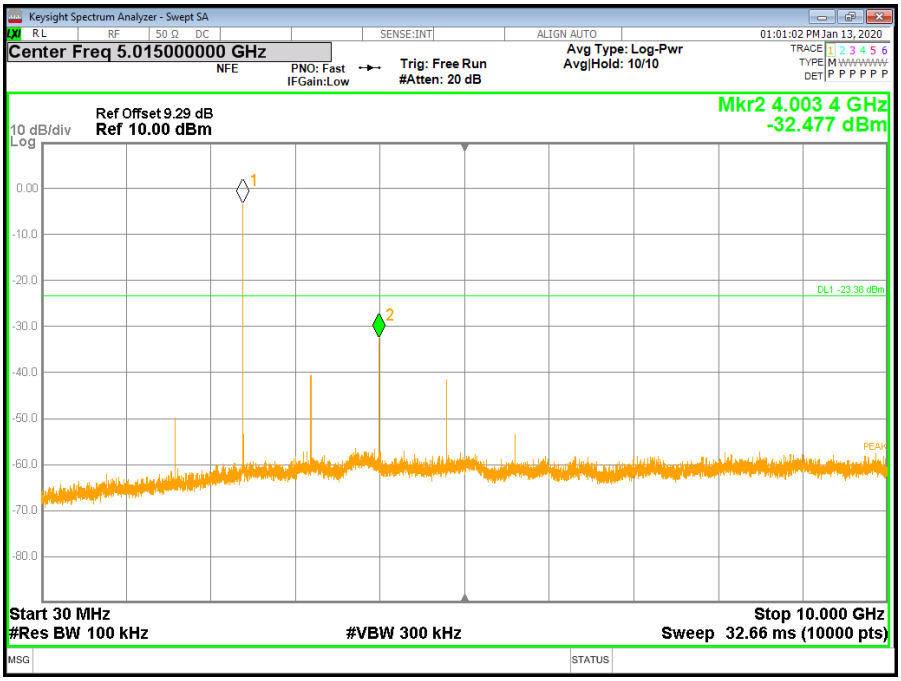
LOW CH BANDEDAGE



LOW CH SPURIOUS EMISSIONS REFERENCE

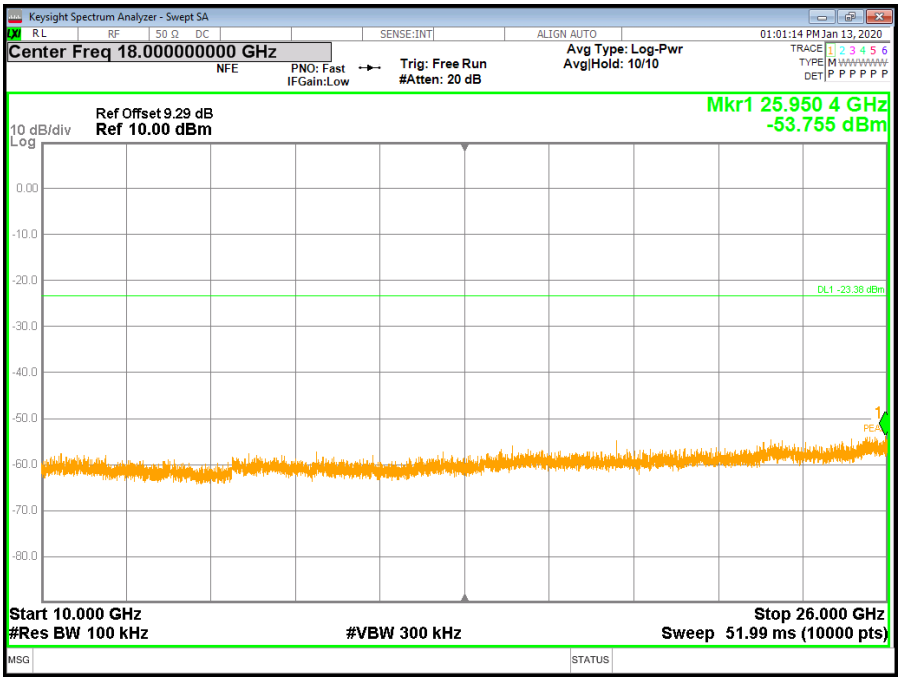


LOW CH SPURIOUS EMISSIONS 30M-10G

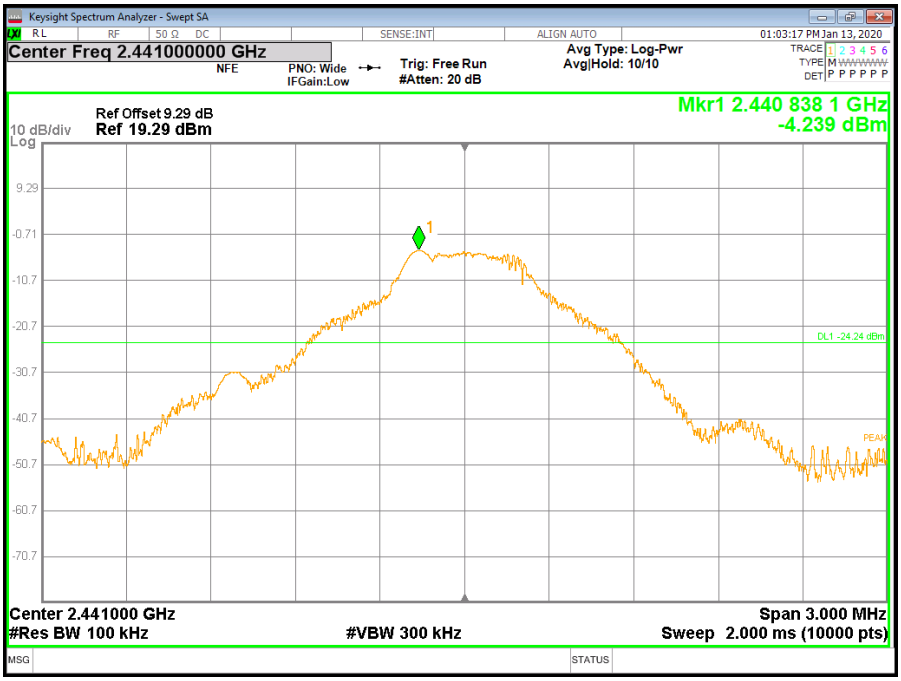


Note: The point 1 is 2.4G main carrier.

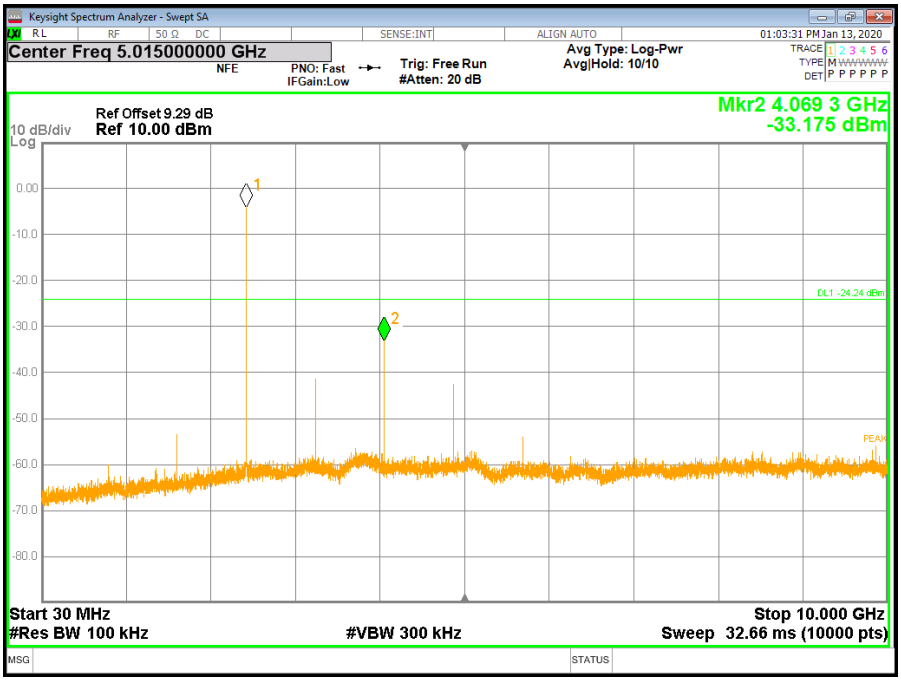
LOW CH SPURIOUS EMISSIONS 10G-26G



MID CH SPURIOUS EMISSIONS REFERENCE

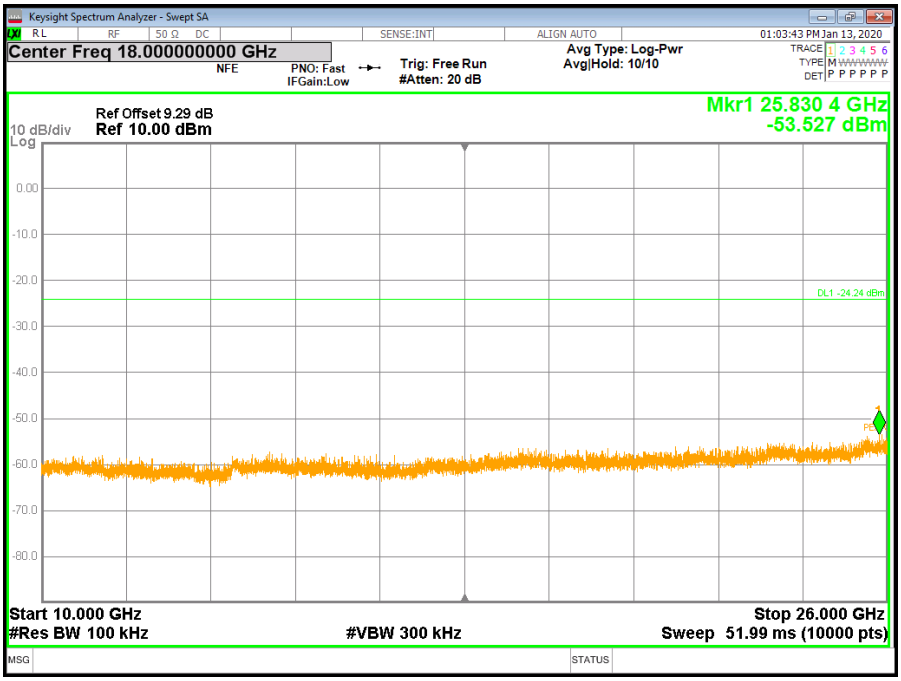


MID CH SPURIOUS EMISSIONS 30M-10G

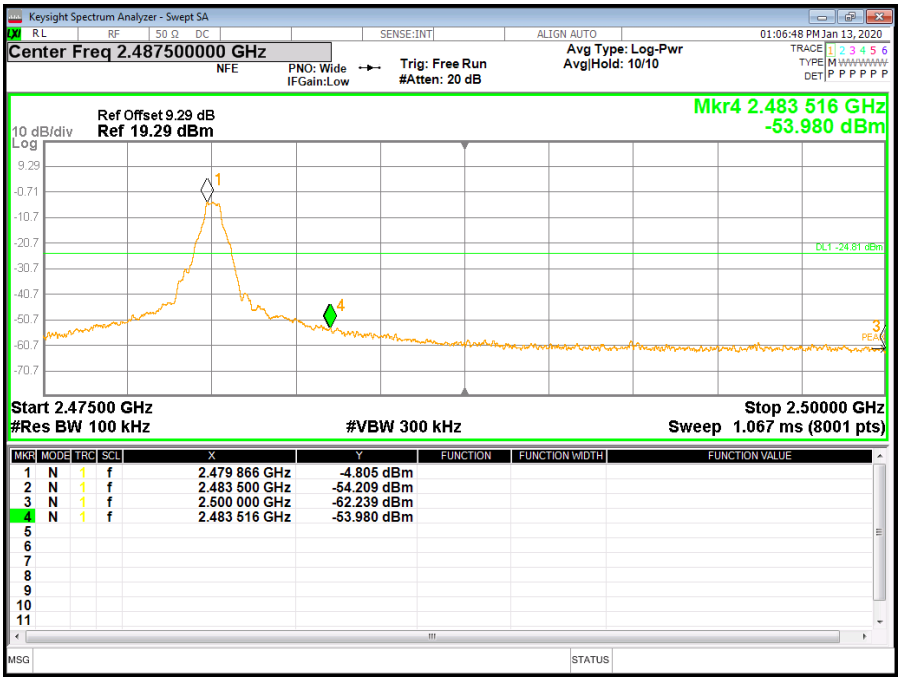


Note: The point 1 is 2.4G main carrier.

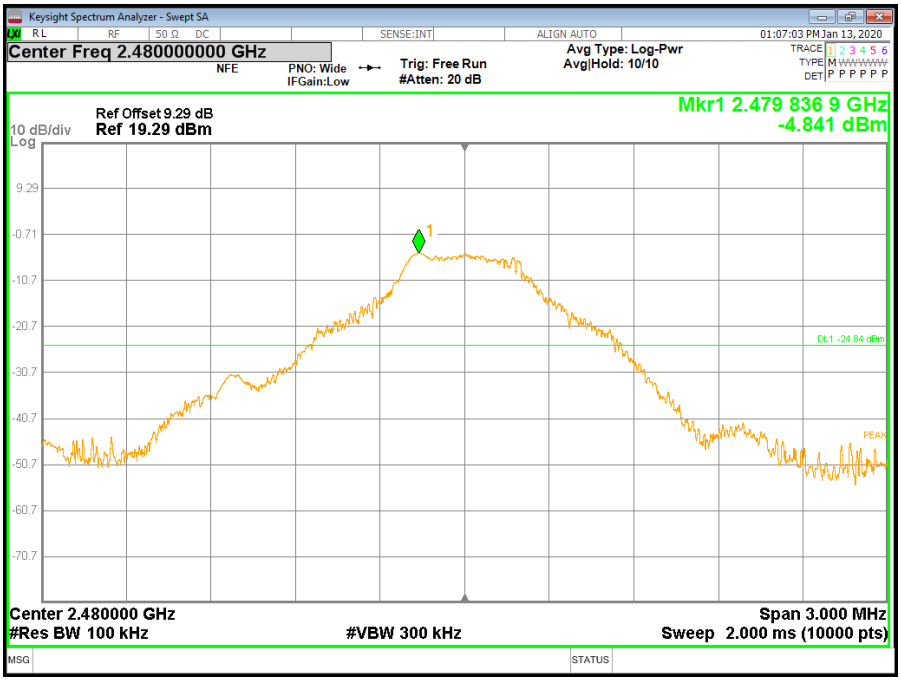
MID CH SPURIOUS EMISSIONS 10G-26G



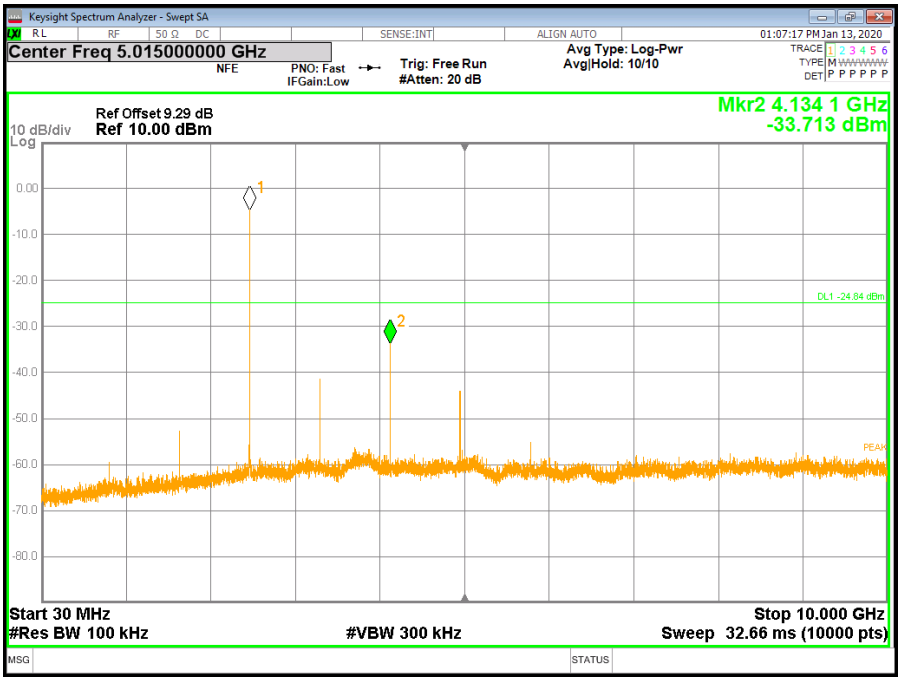
HIGH CH BANDEDAGE



HIGH CH SPURIOUS EMISSIONS REFERENCE

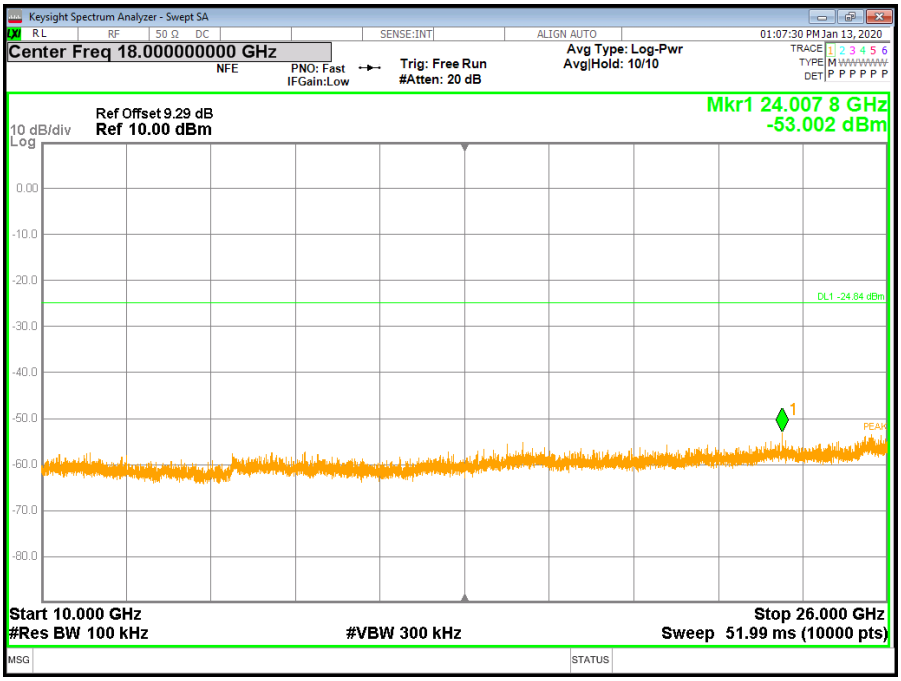


HIGH CH SPURIOUS EMISSIONS 30M-10G



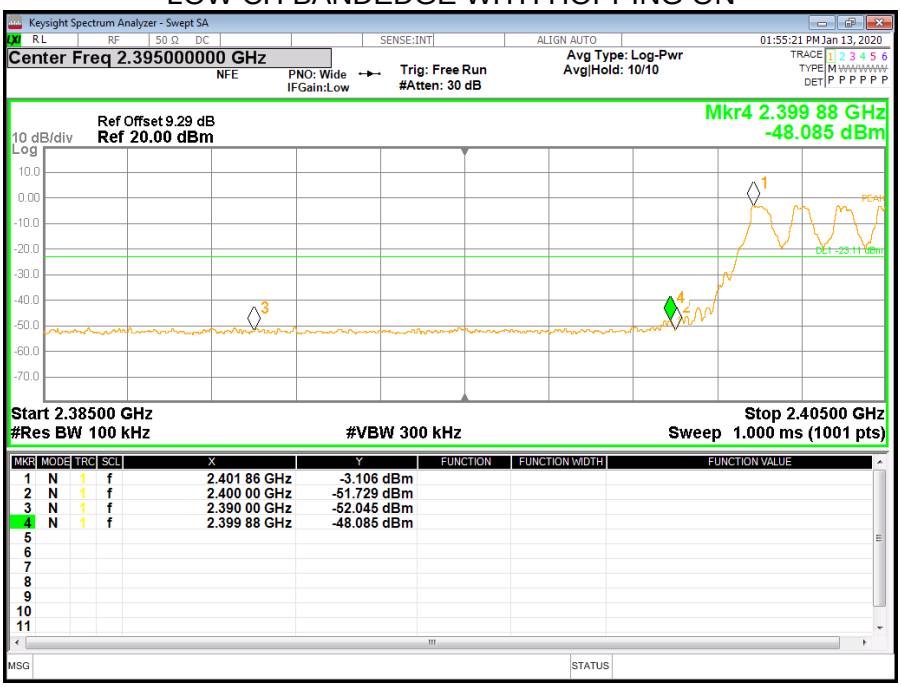
Note: The point 1 is 2.4G main carrier.

HIGH CH SPURIOUS EMISSIONS 10G-26G

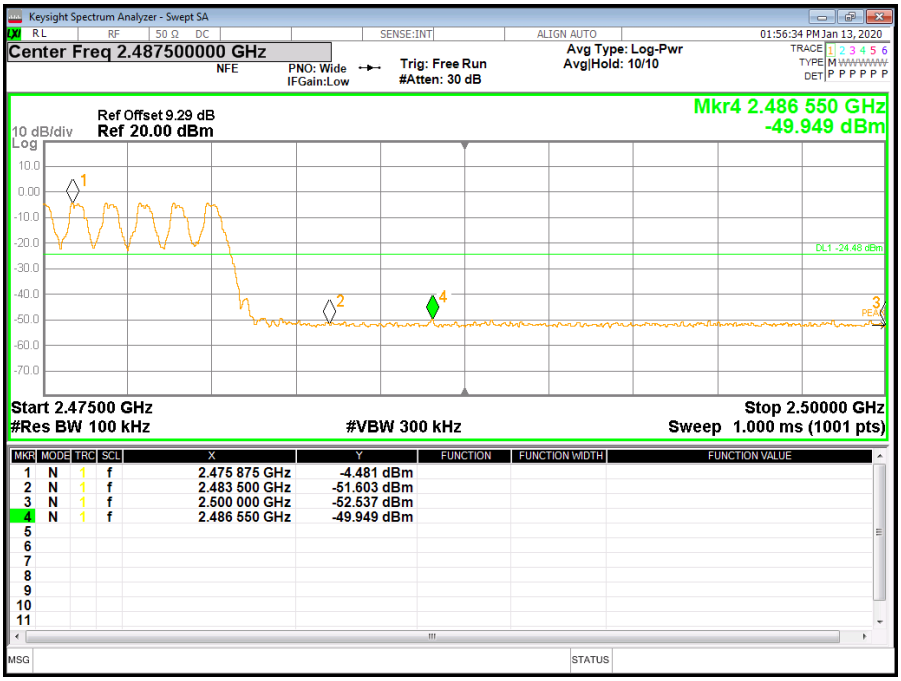


SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

LOW CH BANDEDGE WITH HOPPING ON



HIGH CH BANDEDGE WITH HOPPING ON



8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

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)

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
30~88	100	3
88~216	150	3
216~960	200	3
960~1000	500	3

Note: 1) At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 meters unless it can be further demonstrated that measurements at a distance of 30 meters or less are impractical. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

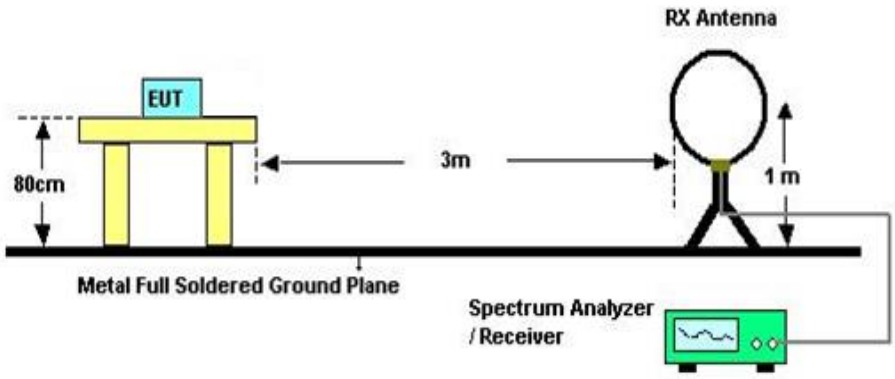
(2) At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). This paragraph (f) shall not apply to Access BPL devices operating below 30 MHz.

Radiation Disturbance Test Limit for FCC (Above 1G)

Frequency (MHz)	dB(uV/m) (at 3 meters)	
	Peak	Average
Above 1000	74	54

About Restricted bands of operation please refer to RSS-Gen section 8.10 and FCC §15.205 (a)

TEST SETUP AND PROCEDURE
Below 30MHz



The setting of the spectrum Analyzer

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 meter above ground.

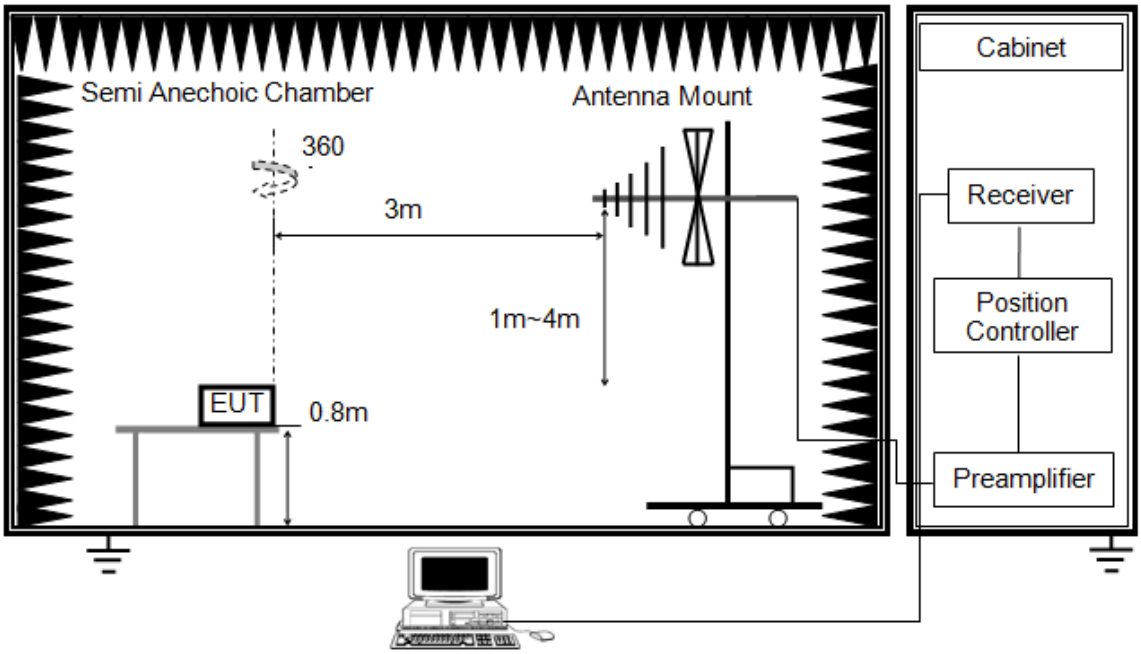
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of 1 meter height antenna tower.

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 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.

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 Analyzer

RBW	120kHz
VBW	300kHz
Sweep	Auto
Trace	Max hold

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

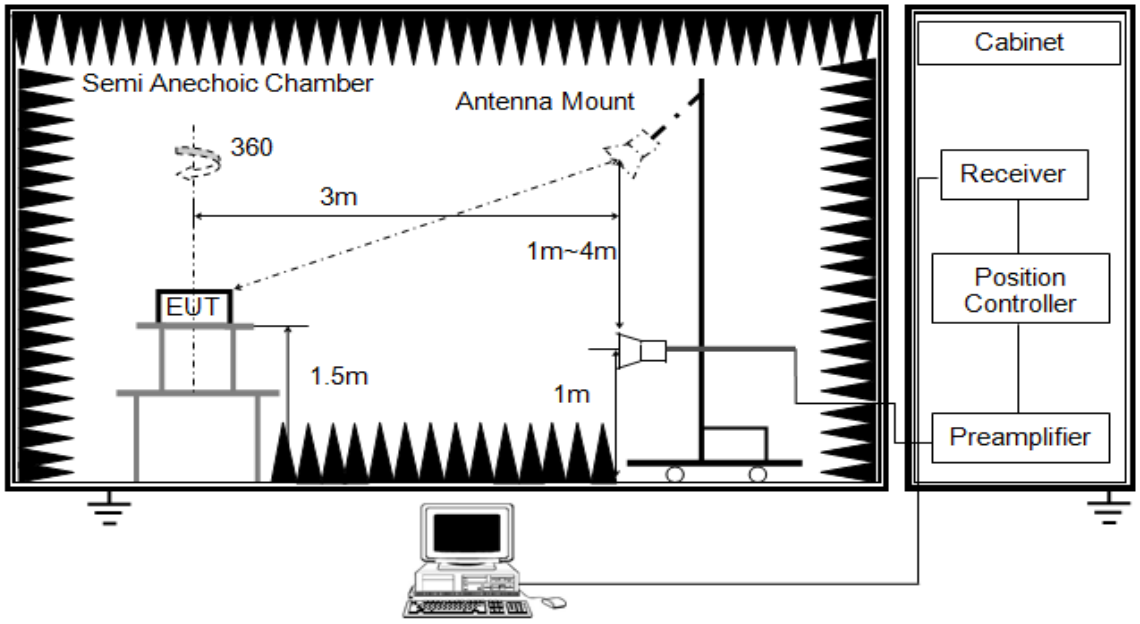
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations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



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 (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.

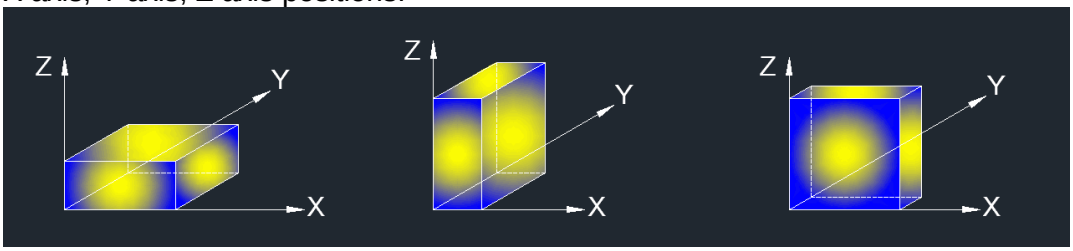
3. The EUT was placed on a turntable with 1.5m above ground.

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 AVG 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

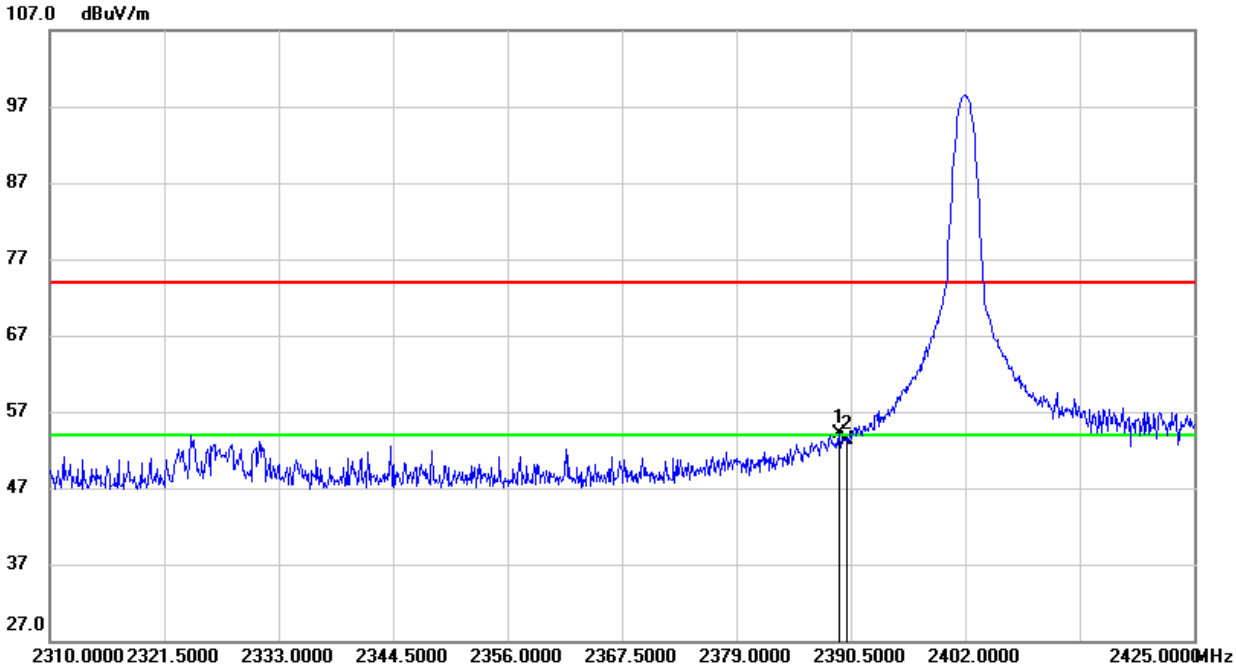
Temperature	24.5°C	Relative Humidity	55%
Atmosphere Pressure	101kPa	Test Voltage	DC 3.7V

8.2. RESTRICTED BANDEDGE

8.2.1. GFSK MODE

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

PEAK

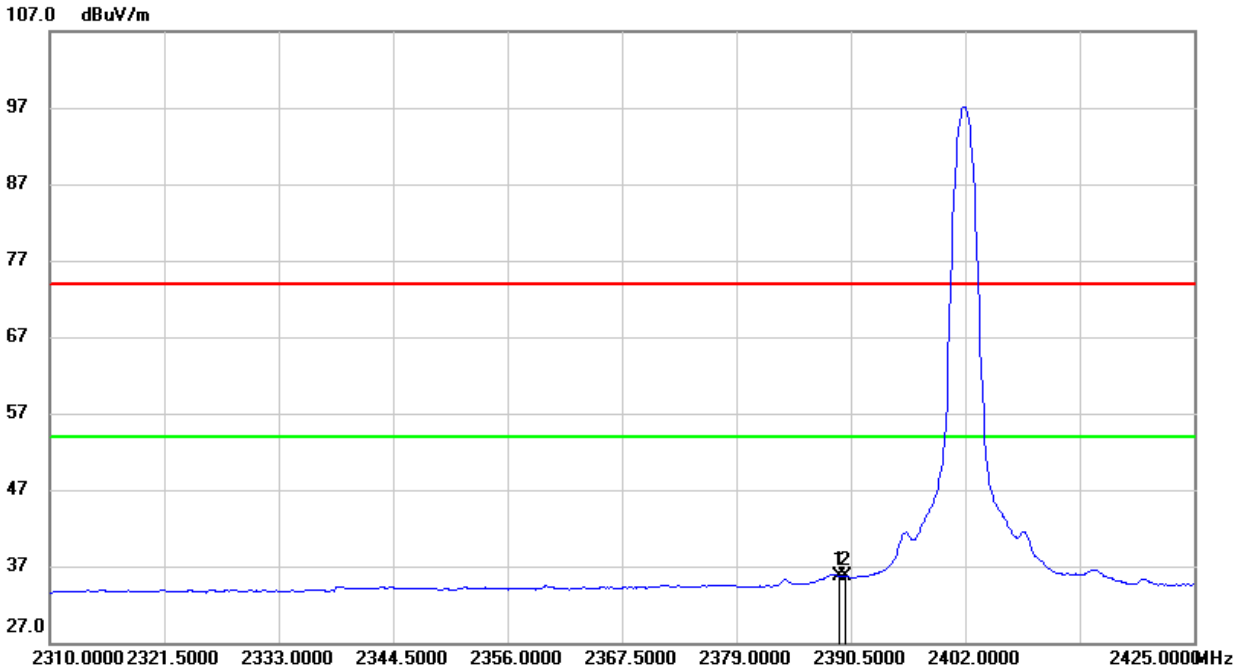


No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2389.350	21.08	32.94	54.02	74.00	-19.98	peak
2	2390.000	20.45	32.94	53.39	74.00	-20.61	peak

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 emission was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

AVG

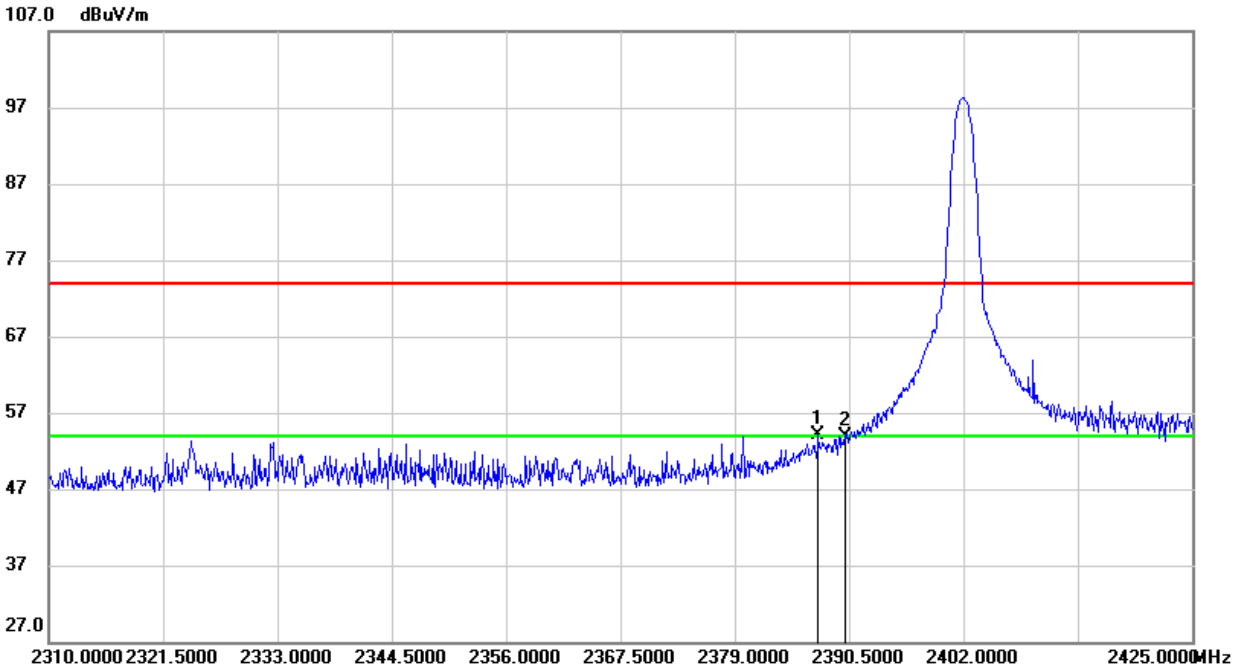


No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2389.350	2.76	32.94	35.70	54.00	-18.30	AVG
2	2390.000	2.72	32.94	35.66	54.00	-18.34	AVG

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. AVG: VBW=1/Ton where: ton is transmit duration.
4. For transmit duration, please refer to clause 7.1.
5. Only the worst case emission was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

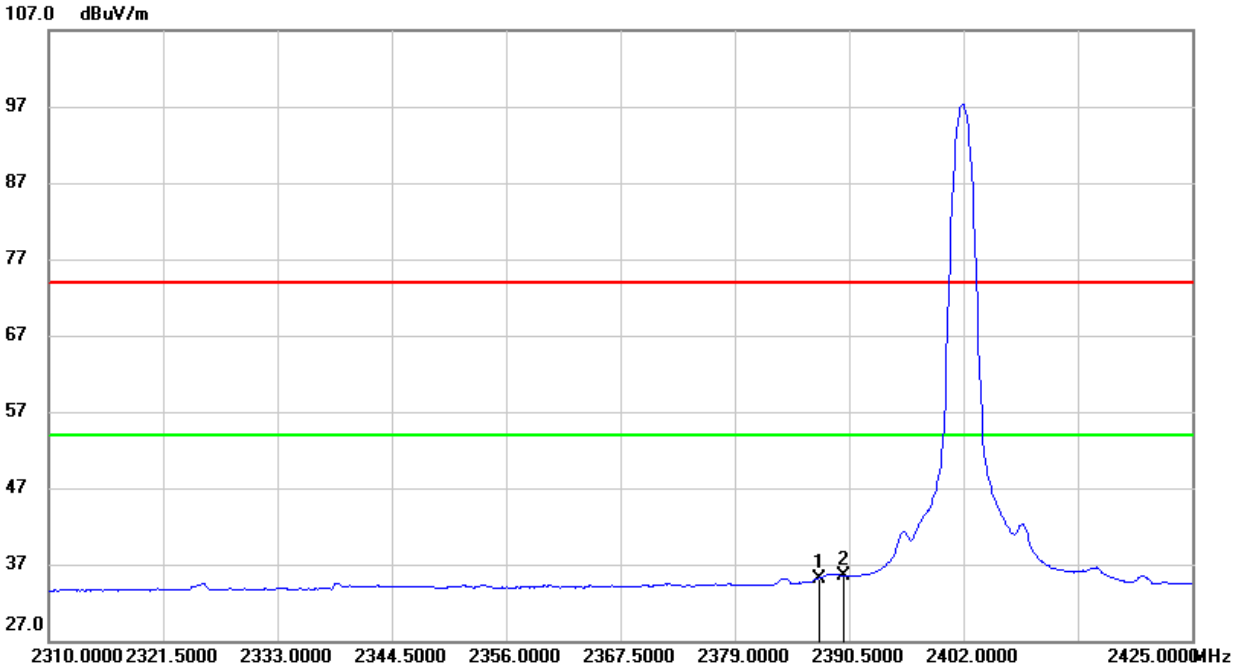
PEAK



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2387.395	21.09	32.94	54.03	74.00	-19.97	peak
2	2390.000	21.06	32.94	54.00	74.00	-20.00	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 was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

AVG

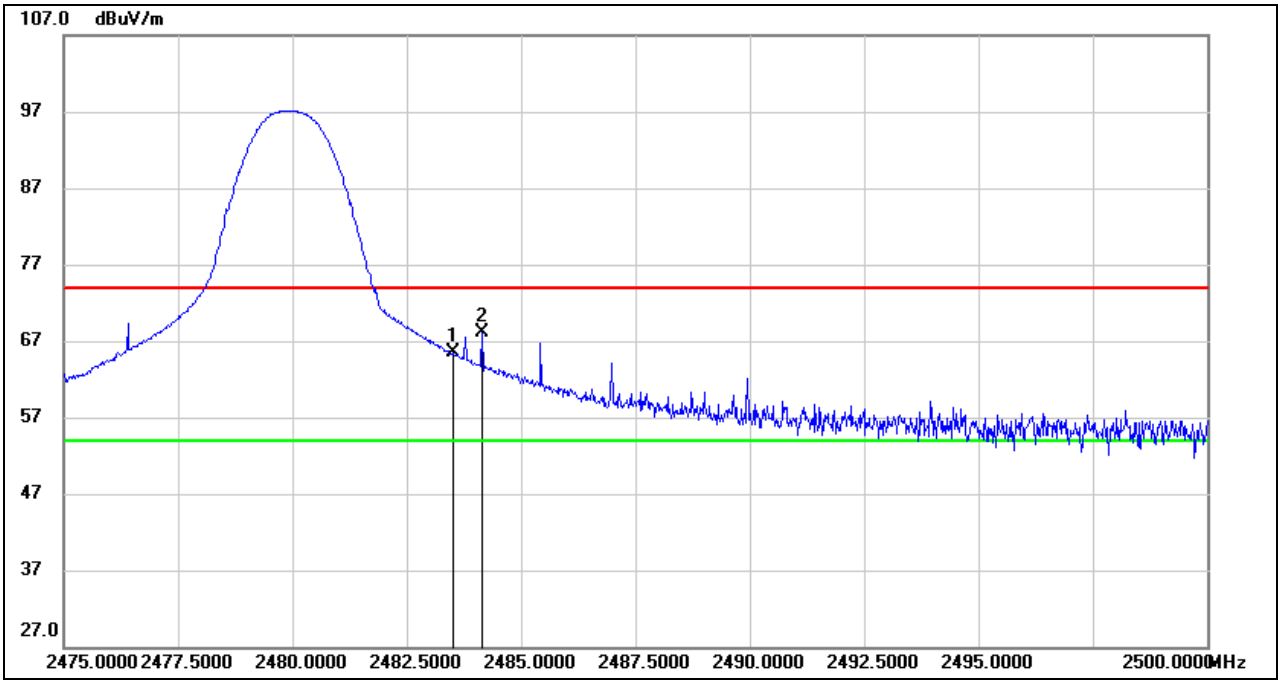


No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2387.395	2.19	32.94	35.13	54.00	-18.87	AVG
2	2390.000	2.55	32.94	35.49	54.00	-18.51	AVG

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. AVG: VBW=1/Ton where: ton is transmit duration.
4. For transmit duration, please refer to clause 7.1.
5. Only the worst case emission was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

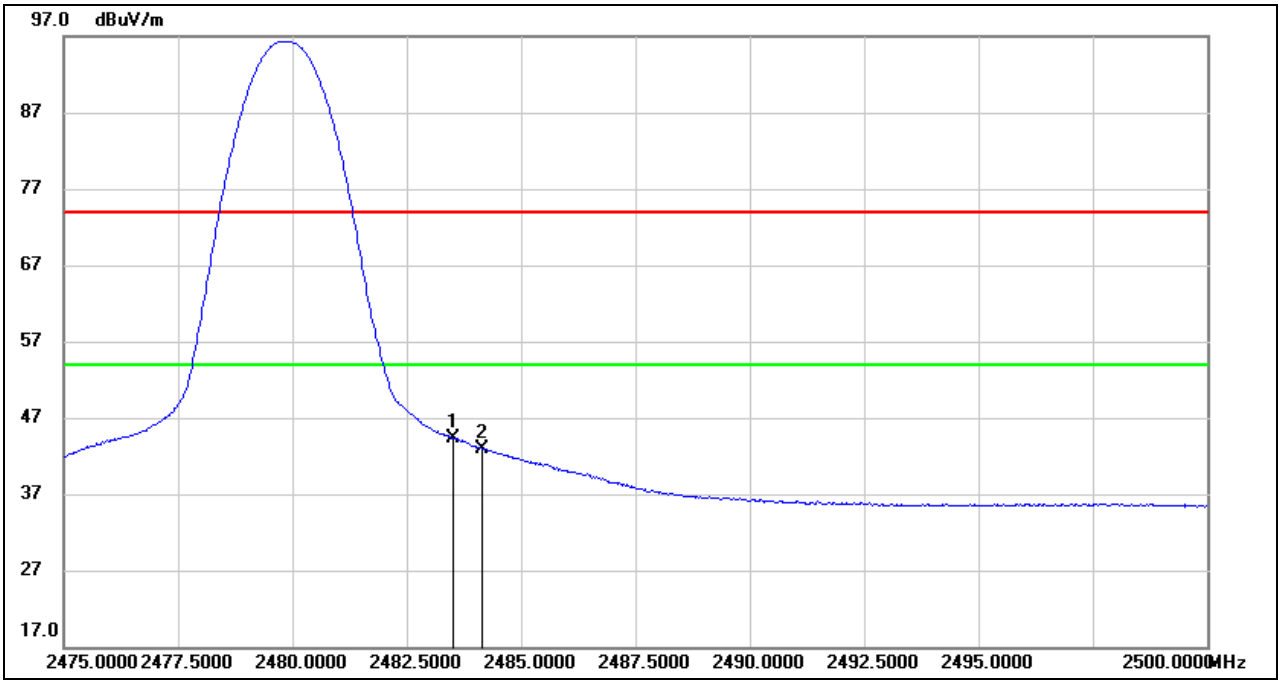
PEAK



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	31.97	33.58	65.55	74.00	-8.45	peak
2	2484.150	34.57	33.58	68.15	74.00	-5.85	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.

AVG

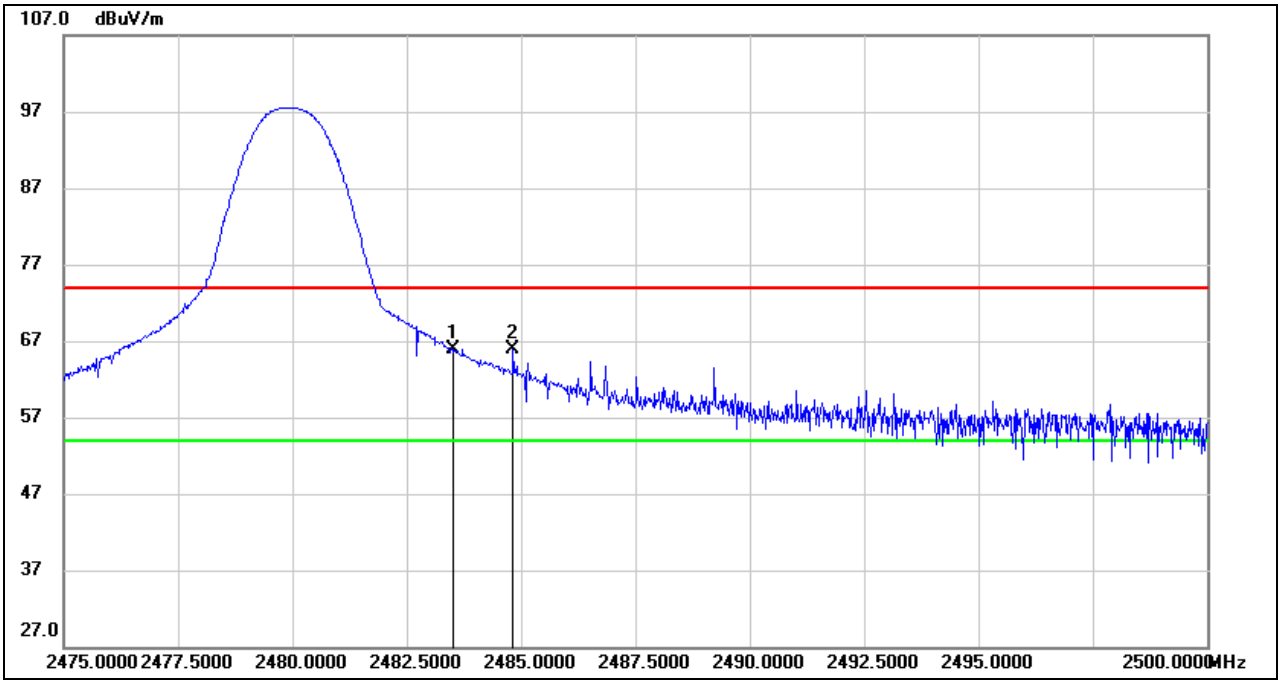


No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	10.78	33.58	44.36	54.00	-9.64	AVG
2	2484.150	9.38	33.58	42.96	54.00	-11.04	AVG

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. AVG: VBW=1/Ton where: ton is transmit duration.
4. For transmit duration, please refer to clause 7.1.
5. Only the worst case emission was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

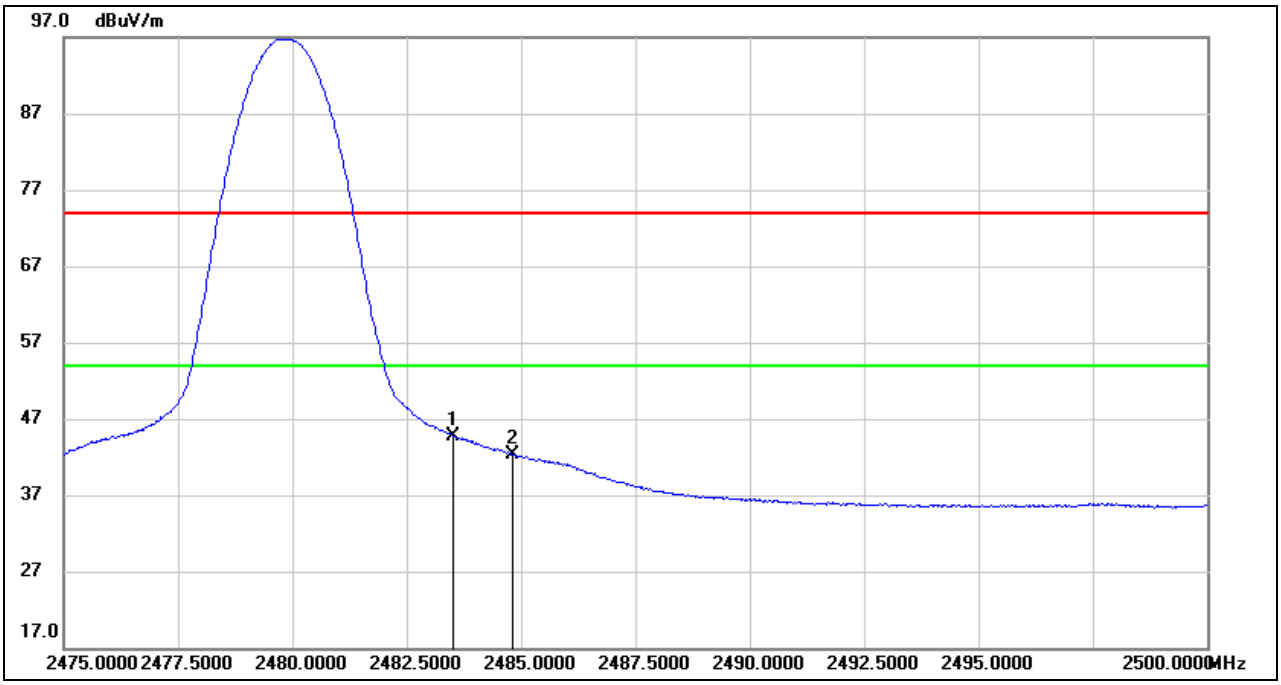
PEAK



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	32.33	33.58	65.91	74.00	-8.09	peak
2	2484.825	32.41	33.59	66.00	74.00	-8.00	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.

AVG



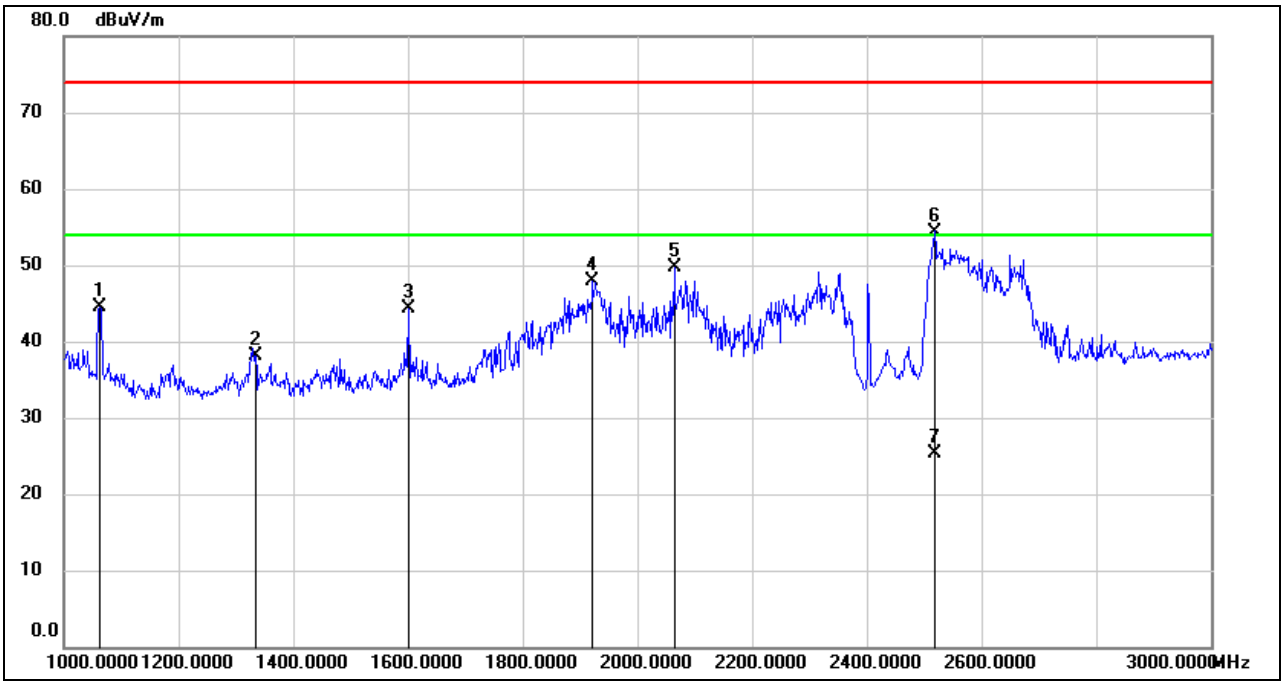
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	11.18	33.58	44.76	54.00	-9.24	AVG
2	2484.825	8.77	33.59	42.36	54.00	-11.64	AVG

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. AVG: VBW=1/Ton where: ton is transmit duration.
4. For transmit duration, please refer to clause 7.1.
5. Only the worst case emission was recorded, if it complies with the limit, the other emissions deemed to comply with the limit.

8.3. SPURIOUS EMISSIONS (1~3GHz)

8.3.1. GFSK MODE

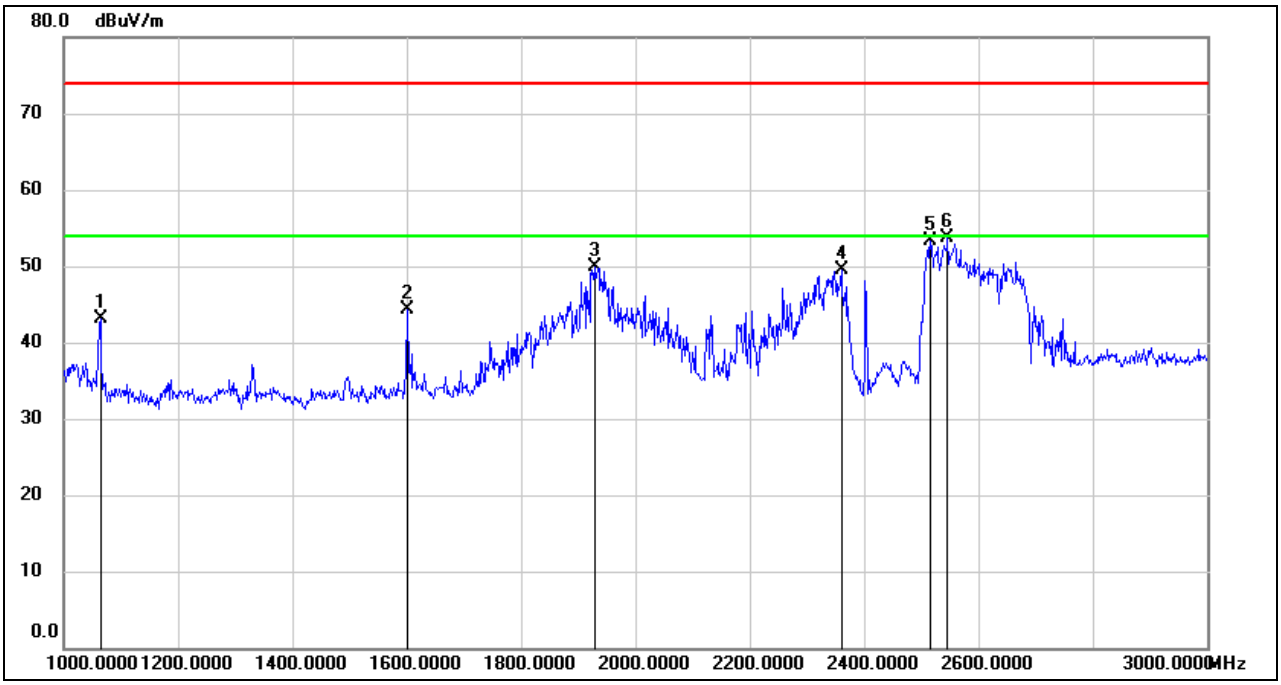
HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1062.000	58.14	-13.55	44.59	74.00	-29.41	peak
2	1334.000	50.38	-12.36	38.02	74.00	-35.98	peak
3	1600.000	55.67	-11.40	44.27	74.00	-29.73	peak
4	1922.000	57.80	-9.93	47.87	74.00	-26.13	peak
5	2064.000	59.11	-9.39	49.72	74.00	-24.28	peak
6	2518.000	61.67	-7.27	54.40	74.00	-19.60	peak
7	2518.000	32.49	-7.27	25.22	54.00	-28.78	AVG

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. AVG: VBW=1/Ton where: ton is transmit duration.
5. For transmit duration, please refer to clause 7.1.
6. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for Band Reject Filter losses.
7. Proper operation of the transmitter prior to adding the filter to the measurement chain.

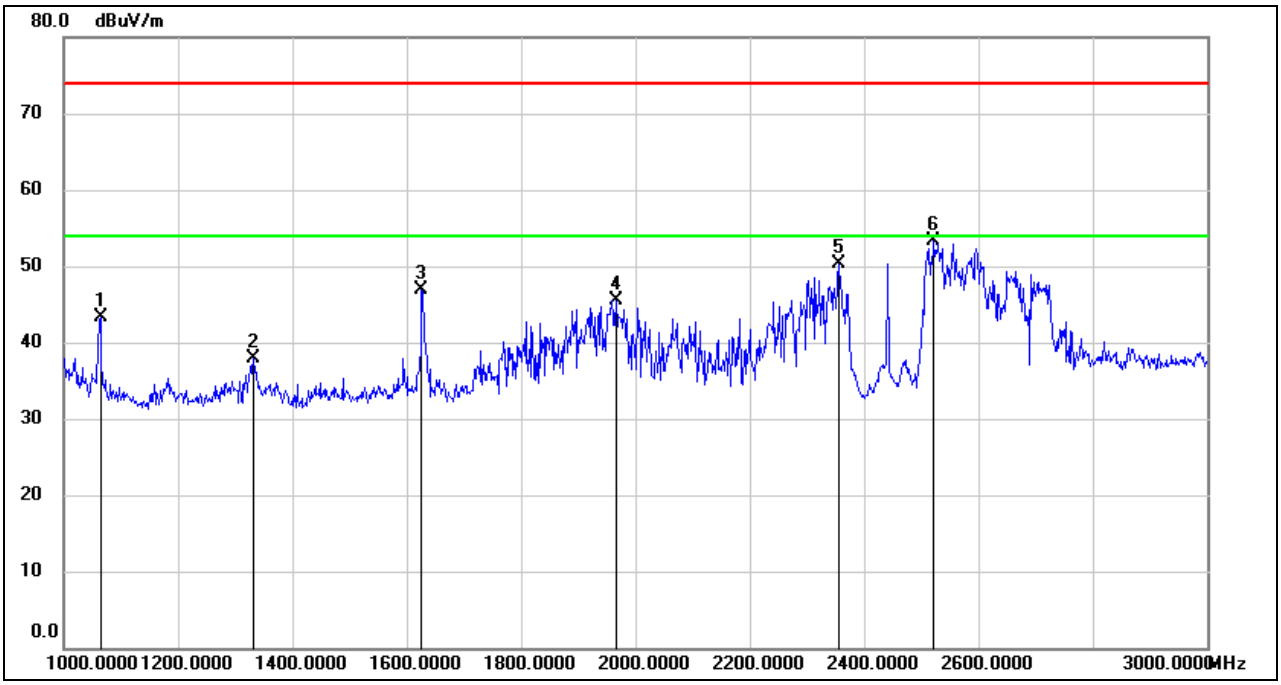
HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, VERTICAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1064.000	56.65	-13.54	43.11	74.00	-30.89	peak
2	1600.000	55.68	-11.40	44.28	74.00	-29.72	peak
3	1928.000	59.78	-9.91	49.87	74.00	-24.13	peak
4	2360.000	57.41	-7.99	49.42	74.00	-24.58	peak
5	2516.000	60.55	-7.25	53.30	74.00	-20.70	peak
6	2546.000	61.13	-7.41	53.72	74.00	-20.28	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 Band Reject Filter losses.
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

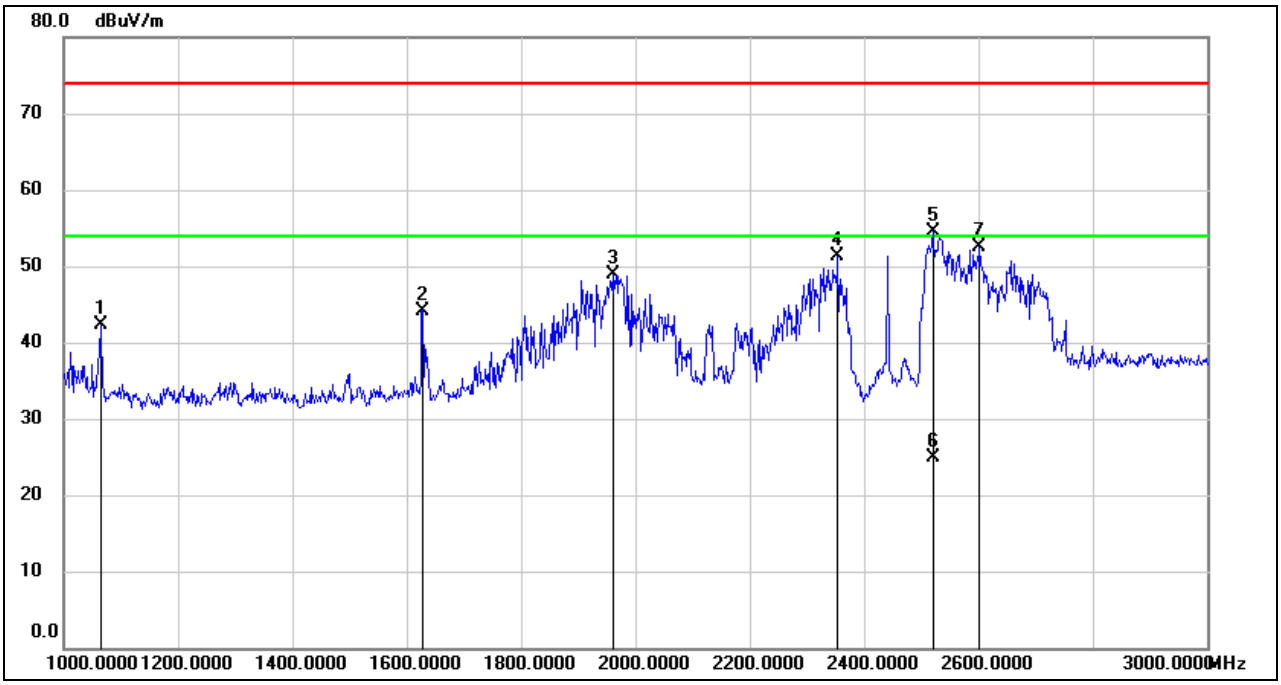
HARMONICS AND SPURIOUS EMISSIONS (MID CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1064.000	56.83	-13.54	43.29	74.00	-30.71	peak
2	1332.000	50.18	-12.35	37.83	74.00	-36.17	peak
3	1626.000	58.16	-11.27	46.89	74.00	-27.11	peak
4	1966.000	55.44	-9.86	45.58	74.00	-28.42	peak
5	2356.000	58.35	-8.00	50.35	74.00	-23.65	peak
6	2522.000	60.59	-7.28	53.31	74.00	-20.69	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 Band Reject Filter losses.
5. Proper operation of the transmitter prior to adding the filter to the measurement chain.

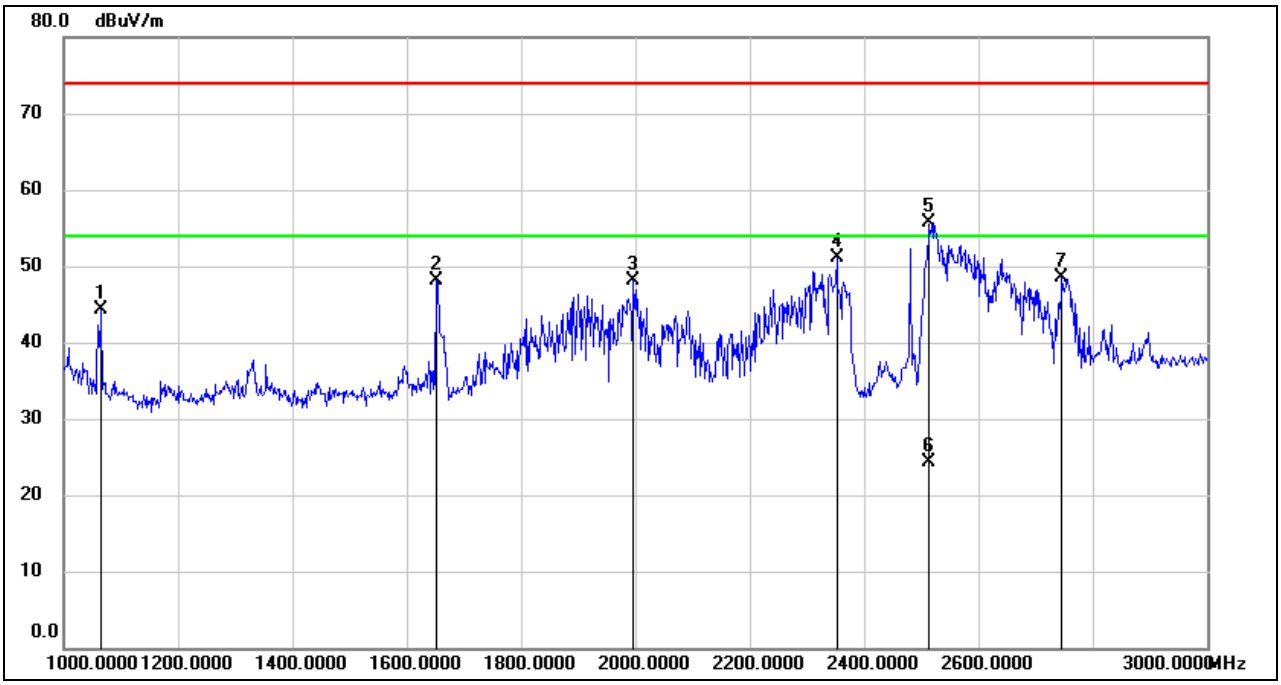
HARMONICS AND SPURIOUS EMISSIONS (MID CHANNEL, VERTICAL)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	1064.000	55.82	-13.54	42.28	74.00	-31.72	peak
2	1628.000	55.45	-11.25	44.20	74.00	-29.80	peak
3	1960.000	58.83	-9.87	48.96	74.00	-25.04	peak
4	2354.000	59.38	-8.01	51.37	74.00	-22.63	peak
5	2518.760	61.77	-7.27	54.50	74.00	-19.50	peak
6	2518.760	32.16	-7.27	24.89	54.00	-29.11	AVG
7	2602.000	60.14	-7.69	52.45	74.00	-21.55	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. AVG: VBW=1/Ton where: ton is transmit duration.
5. For transmit duration, please refer to clause 7.1.
6. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for Band Reject Filter losses.
7. Proper operation of the transmitter prior to adding the filter to the measurement chain.

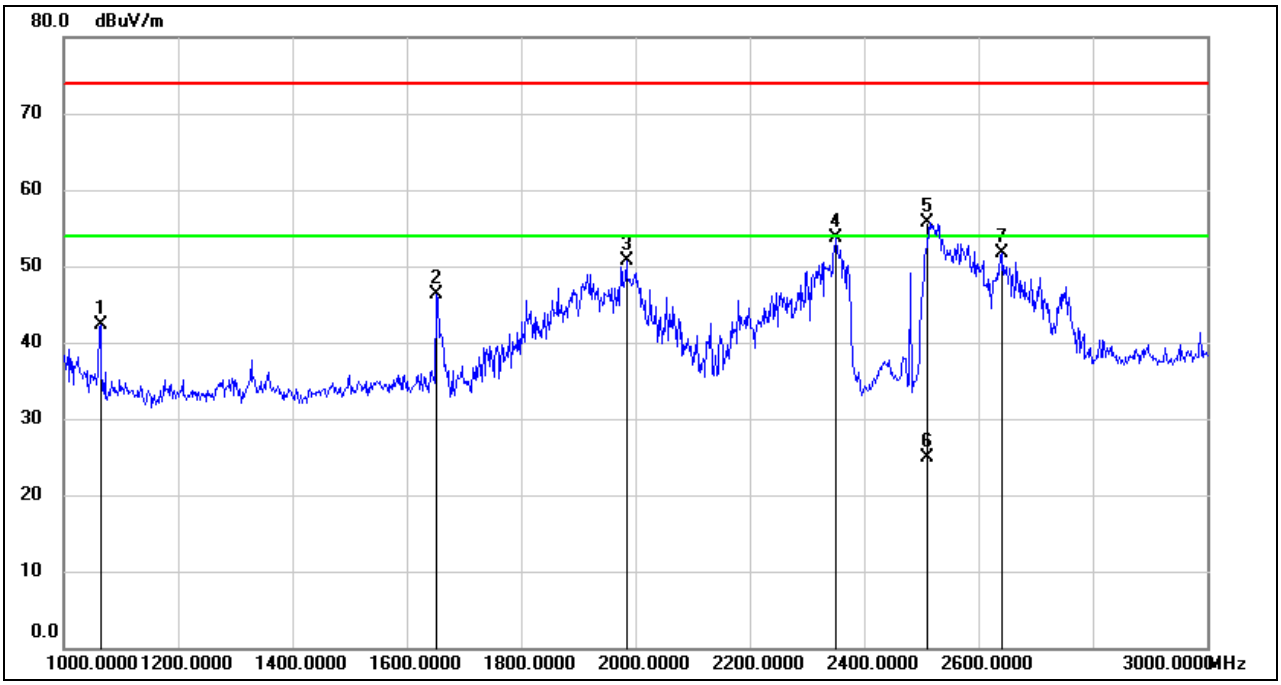
HARMONICS AND SPURIOUS EMISSIONS (HIGH CHANNEL, HORIZONTAL)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	1066.000	57.84	-13.54	44.30	74.00	-29.70	peak
2	1652.000	59.28	-11.14	48.14	74.00	-25.86	peak
3	1996.000	57.94	-9.83	48.11	74.00	-25.89	peak
4	2352.000	59.03	-8.02	51.01	74.00	-22.99	peak
5	2514.550	63.02	-7.25	55.77	74.00	-18.23	peak
6	2514.550	31.50	-7.25	24.25	54.00	-29.75	AVG
7	2746.000	55.09	-6.63	48.46	74.00	-25.54	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. AVG: VBW=1/Ton where: ton is transmit duration.
5. For transmit duration, please refer to clause 7.1.
6. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for Band Reject Filter losses.
7. Proper operation of the transmitter prior to adding the filter to the measurement chain.

HARMONICS AND SPURIOUS EMISSIONS (HIGH CHANNEL, VERTICAL)



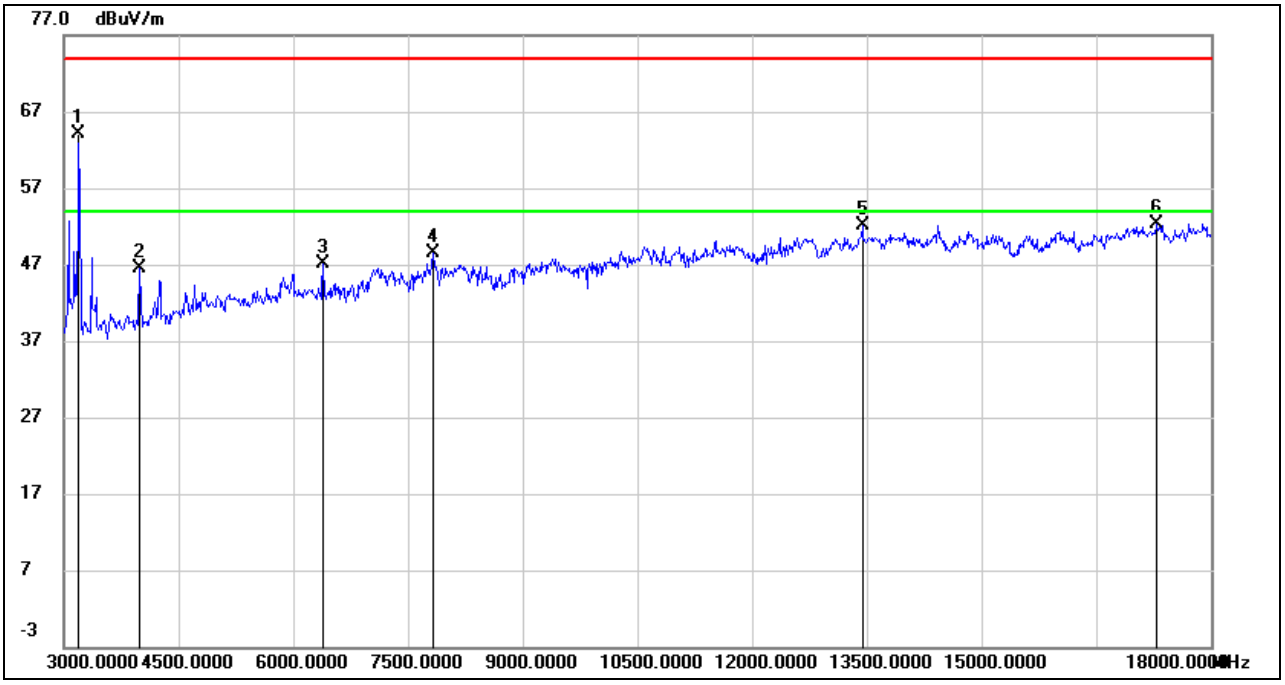
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	1064.000	55.77	-13.54	42.23	74.00	-31.77	peak
2	1652.000	57.51	-11.14	46.37	74.00	-27.63	peak
3	1984.000	60.45	-9.84	50.61	74.00	-23.39	peak
4	2350.000	61.76	-8.02	53.74	74.00	-20.26	peak
5	2509.910	62.82	-7.21	55.61	74.00	-18.39	peak
6	2509.910	32.03	-7.21	24.82	54.00	-29.18	AVG
7	2642.000	59.22	-7.46	51.76	74.00	-22.24	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. AVG: VBW=1/Ton where: ton is transmit duration.
5. For transmit duration, please refer to clause 7.1.
6. Filter losses were only considered in the spurious frequency bands and the authorized band was not corrected for Band Reject Filter losses.
7. Proper operation of the transmitter prior to adding the filter to the measurement chain.

8.4. SPURIOUS EMISSIONS (3~18GHz)

8.4.1. GFSK MODE

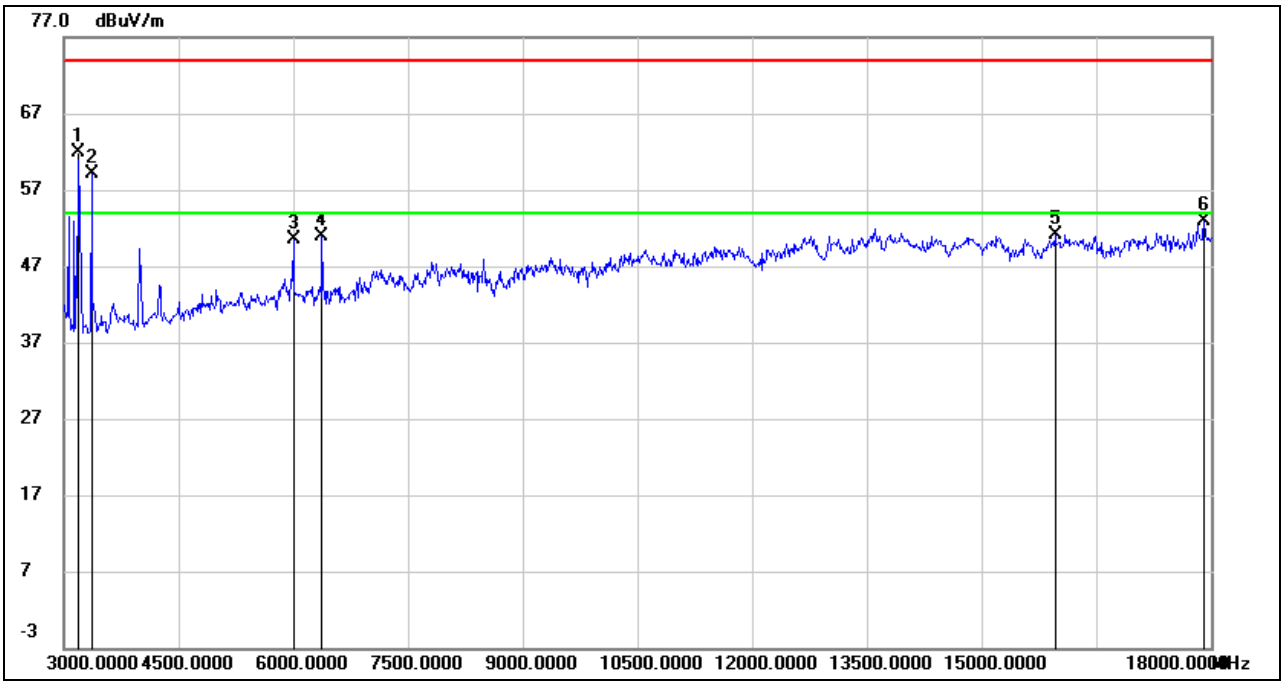
HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, HORIZONTAL)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1*	3202.592	68.60	-4.45	64.15	/	/	peak
2	3990.000	49.41	-2.89	46.52	74.00	-27.48	peak
3*	6390.000	42.73	4.28	47.01	/	/	peak
4*	7830.000	40.71	7.72	48.43	/	/	peak
5*	13440.000	36.14	15.98	52.12	/	/	peak
6*	17295.000	30.56	21.71	52.27	/	/	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.
6. *indicates the frequency is out of the restricted bands and the limit is referring to 15.247 (d) and RSS-247 clause 5.5. We had already performed the conducted non-restricted bands test, please refer to clause 7.7.

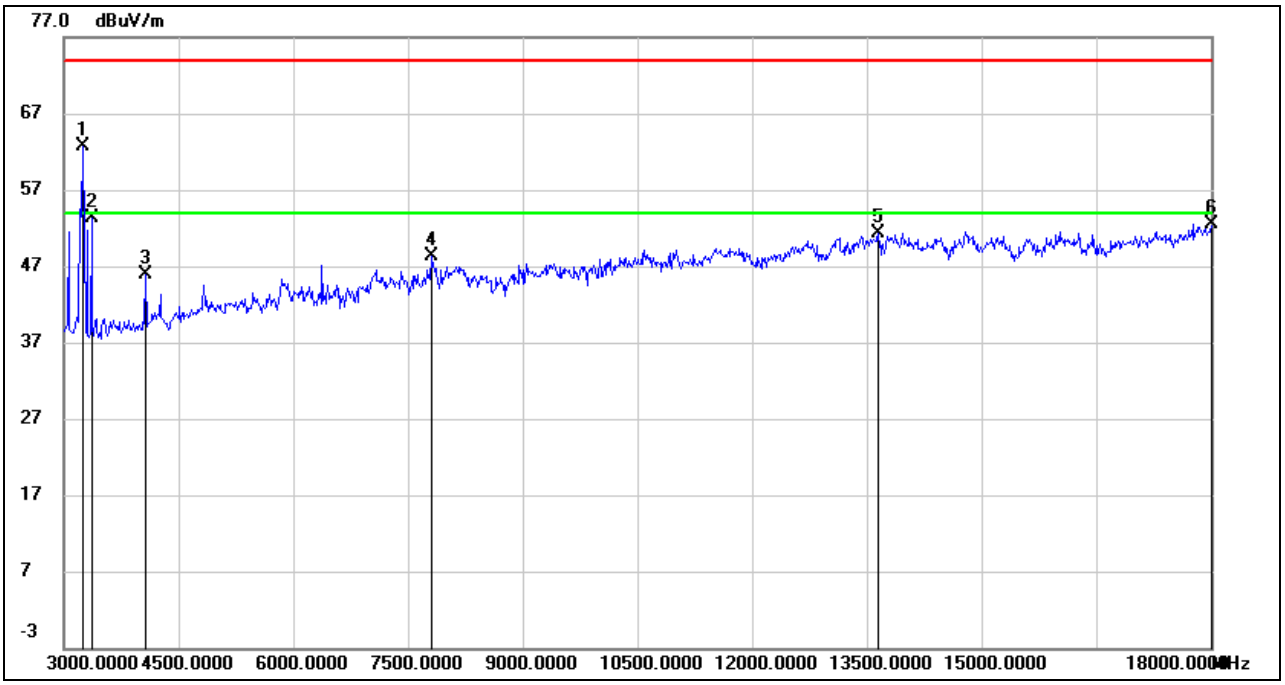
HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, VERTICAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1*	3202.632	66.34	-4.45	61.89	/	/	peak
2*	3371.479	63.43	-4.35	59.08	/	/	peak
3*	6000.000	47.12	3.29	50.41	/	/	peak
4*	6375.000	46.61	4.22	50.83	/	/	peak
5	15960.000	33.41	17.63	51.04	74.00	-22.96	peak
6	17910.000	29.49	23.35	52.84	74.00	-21.16	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.
6. *indicates the frequency is out of the restricted bands and the limit is referring to 15.247 (d) and RSS-247 clause 5.5. We had already performed the conducted non-restricted bands test, please refer to clause 7.7.

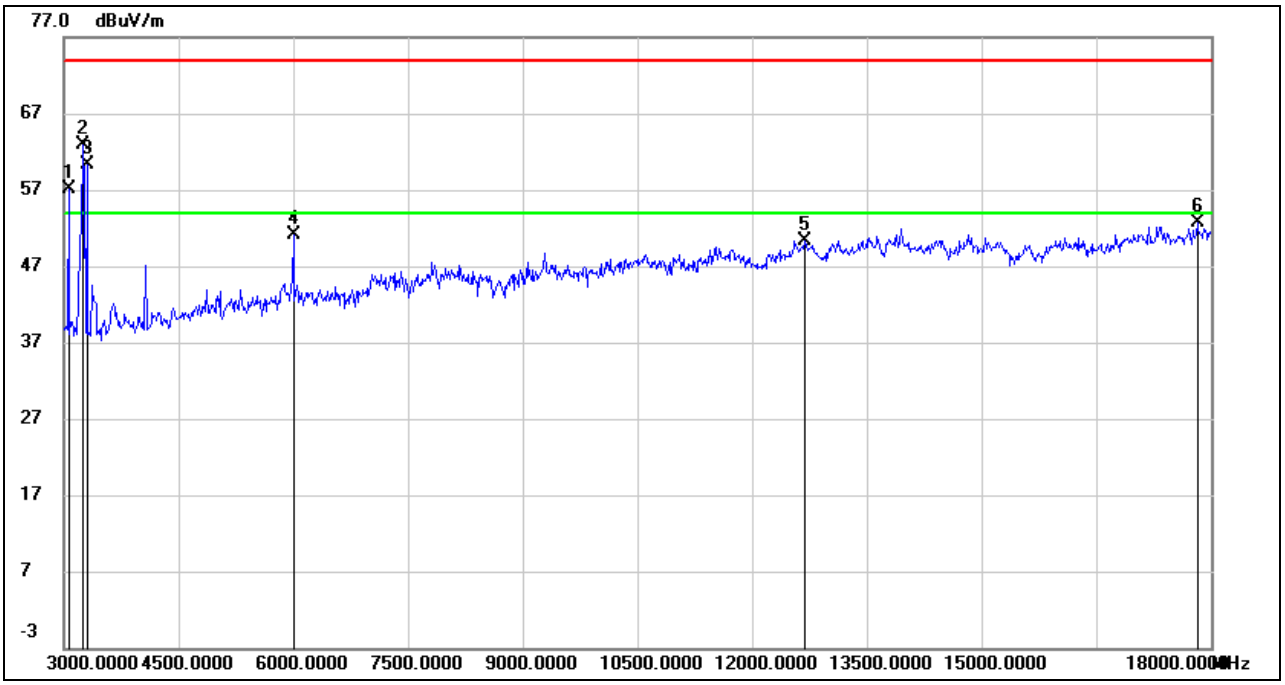
HARMONICS AND SPURIOUS EMISSIONS (MID CHANNEL, HORIZONTAL)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1*	3240.000	67.02	-4.37	62.65	/	/	peak
2*	3360.000	57.54	-4.33	53.21	/	/	peak
3	4065.000	48.80	-2.88	45.92	74.00	-28.08	peak
4*	7800.000	40.35	7.93	48.28	/	/	peak
5*	13650.000	35.37	15.94	51.31	/	/	peak
6	18000.000	29.10	23.46	52.56	74.00	-21.44	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.
6. *indicates the frequency is out of the restricted bands and the limit is referring to 15.247 (d) and RSS-247 clause 5.5. We had already performed the conducted non-restricted bands test, please refer to clause 7.7.

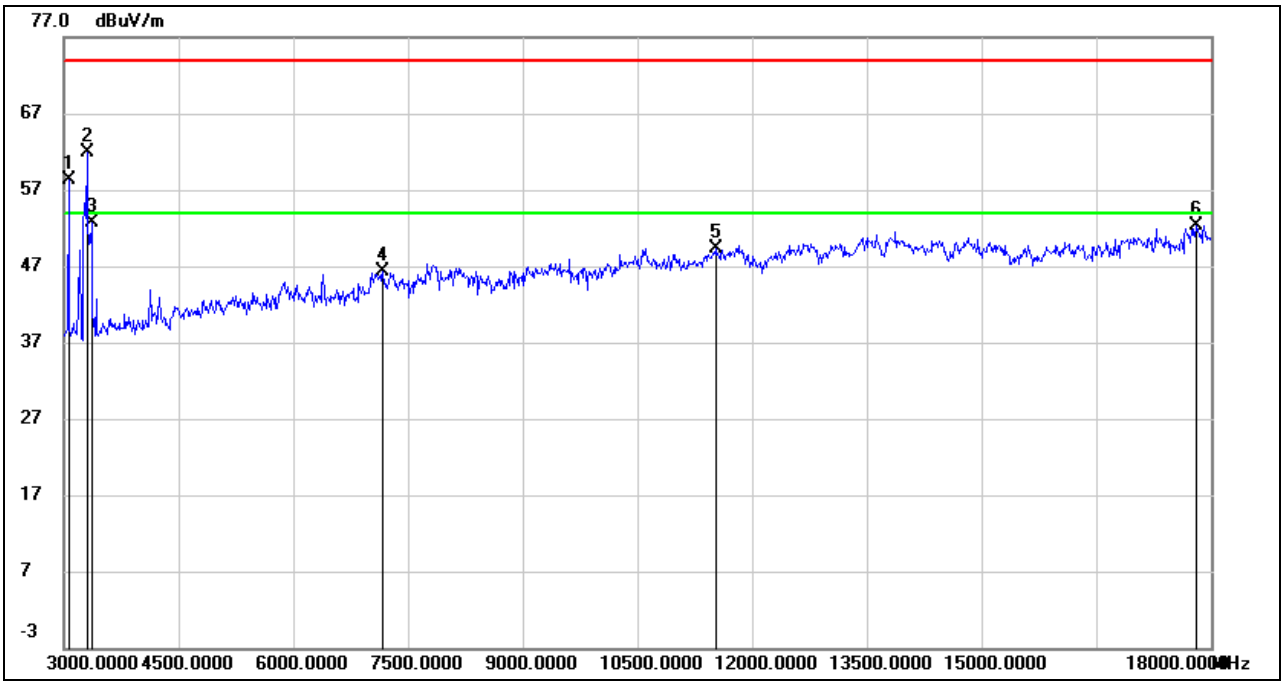
HARMONICS AND SPURIOUS EMISSIONS (MID CHANNEL, VERTICAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1*	3060.000	61.00	-3.96	57.04	/	/	peak
2*	3255.000	67.21	-4.34	62.87	/	/	peak
3*	3308.402	64.49	-4.24	60.25	/	/	peak
4*	6000.000	47.84	3.29	51.13	/	/	peak
5	12690.000	36.02	14.25	50.27	74.00	-23.73	peak
6	17820.000	29.41	23.30	52.71	74.00	-21.29	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.
6. *indicates the frequency is out of the restricted bands and the limit is referring to 15.247 (d) and RSS-247 clause 5.5. We had already performed the conducted non-restricted bands test, please refer to clause 7.7.

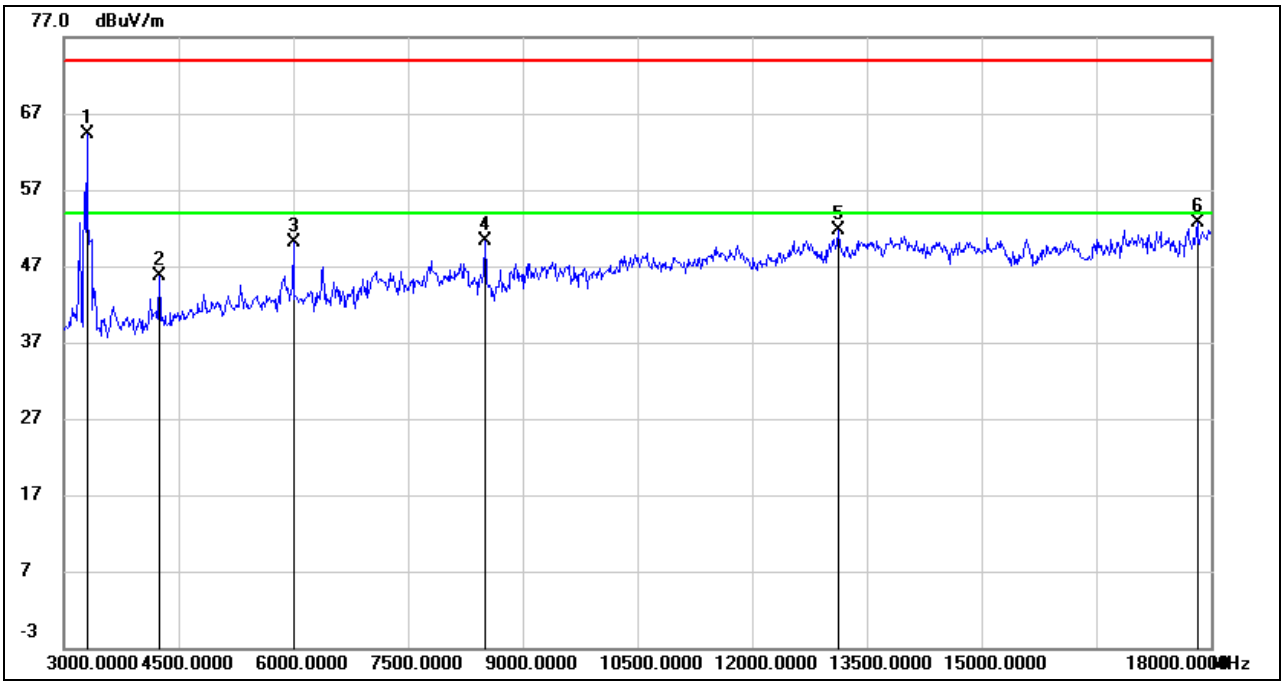
HARMONICS AND SPURIOUS EMISSIONS (HIGH CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1*	3060.000	62.31	-3.96	58.35	/	/	peak
2*	3300.000	66.22	-4.24	61.98	/	/	peak
3*	3360.000	57.07	-4.33	52.74	/	/	peak
4*	7170.000	40.43	5.84	46.27	/	/	peak
5	11520.000	35.86	13.38	49.24	74.00	-24.76	peak
6	17805.000	29.08	23.31	52.39	74.00	-21.61	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.
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.
6. *indicates the frequency is out of the restricted bands and the limit is referring to 15.247 (d) and RSS-247 clause 5.5. We had already performed the conducted non-restricted bands test, please refer to clause 7.7.

HARMONICS AND SPURIOUS EMISSIONS (HIGH CHANNEL, VERTICAL)



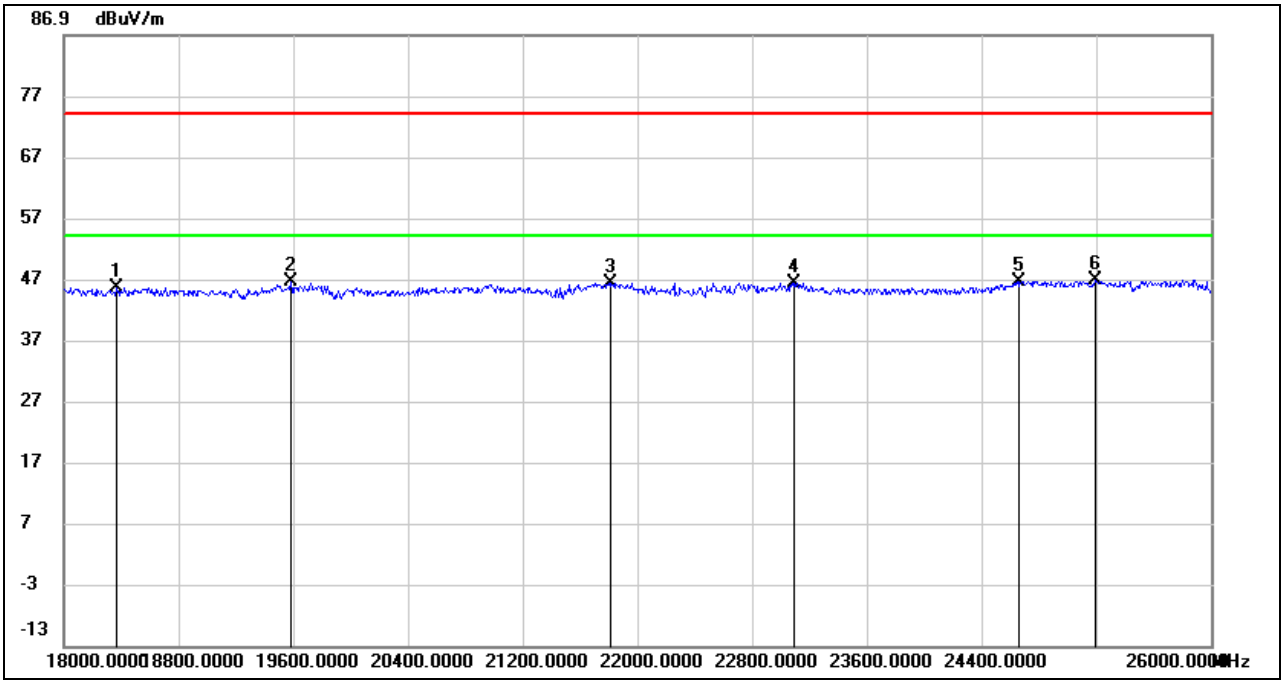
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1*	3300.000	68.52	-4.24	64.28	/	/	peak
2	4245.000	47.32	-1.59	45.73	74.00	-28.27	peak
3*	6000.000	46.79	3.29	50.08	/	/	peak
4*	8505.000	42.86	7.41	50.27	/	/	peak
5*	13125.000	36.58	15.17	51.75	/	/	peak
6	17820.000	29.36	23.30	52.66	74.00	-21.34	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.
6. *indicates the frequency is out of the restricted bands and the limit is referring to 15.247 (d) and RSS-247 clause 5.5. We had already performed the conducted non-restricted bands test, please refer to clause 7.7.

8.5. SPURIOUS EMISSIONS 18G ~ 26GHz

8.5.1. GFSK MODE

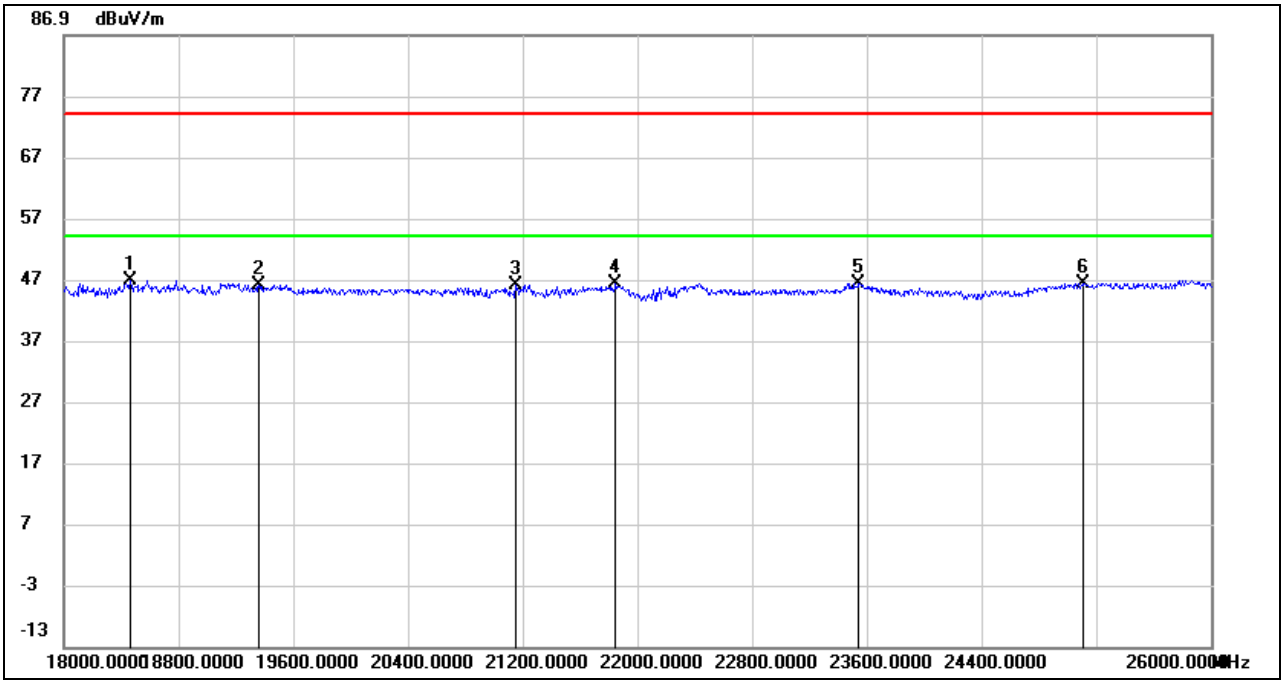
SPURIOUS EMISSIONS (LOW CHANNEL, WORST-CASE CONFIGURATION, HORIZONTAL)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	18368.000	50.01	-4.38	45.63	74.00	-28.37	peak
2	19584.000	51.17	-4.64	46.53	74.00	-27.47	peak
3	21816.000	52.22	-5.88	46.34	74.00	-27.66	peak
4	23096.000	51.80	-5.47	46.33	74.00	-27.67	peak
5	24664.000	48.82	-2.18	46.64	74.00	-27.36	peak
6	25192.000	47.99	-1.16	46.83	74.00	-27.17	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.

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	18464.000	51.20	-4.39	46.81	74.00	-27.19	peak
2	19360.000	51.04	-4.93	46.11	74.00	-27.89	peak
3	21152.000	51.56	-5.42	46.14	74.00	-27.86	peak
4	21848.000	52.26	-5.95	46.31	74.00	-27.69	peak
5	23544.000	51.13	-4.73	46.40	74.00	-27.60	peak
6	25104.000	47.52	-1.12	46.40	74.00	-27.60	peak

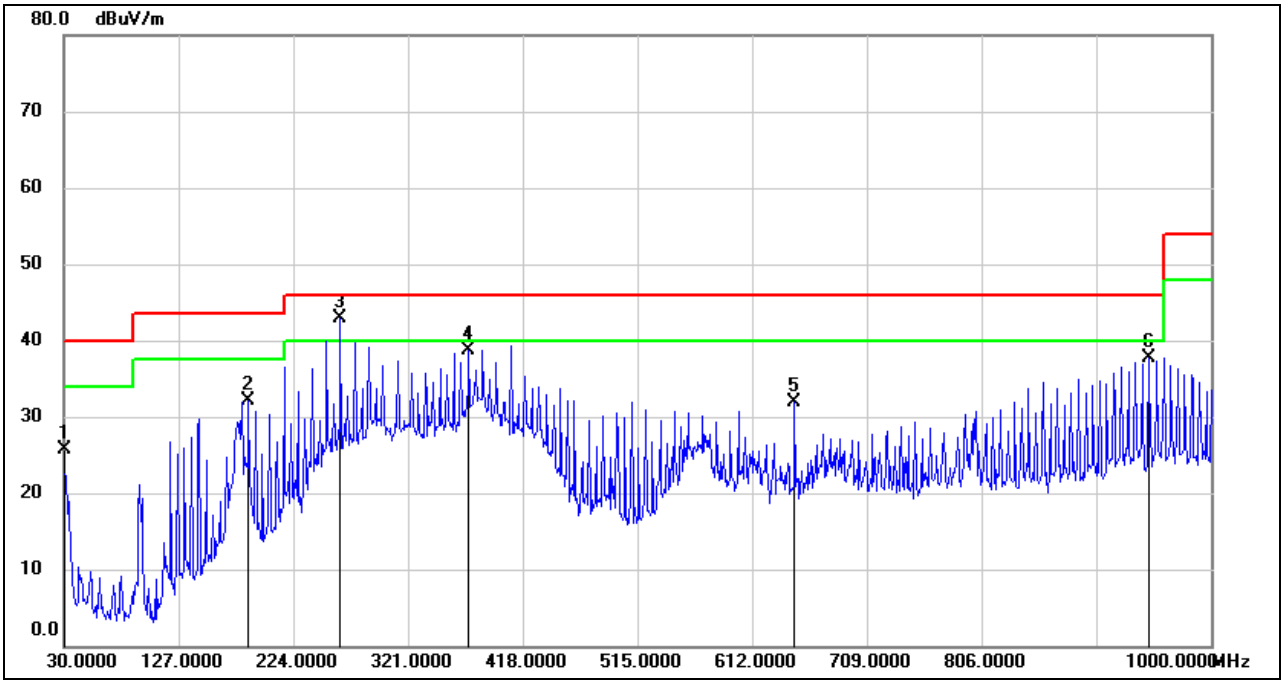
Note: 1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.

Note: All test mode has been tested, only the worst data record in the report.

8.6. SPURIOUS EMISSIONS 30M ~ 1 GHz

8.6.1. GFSK MODE

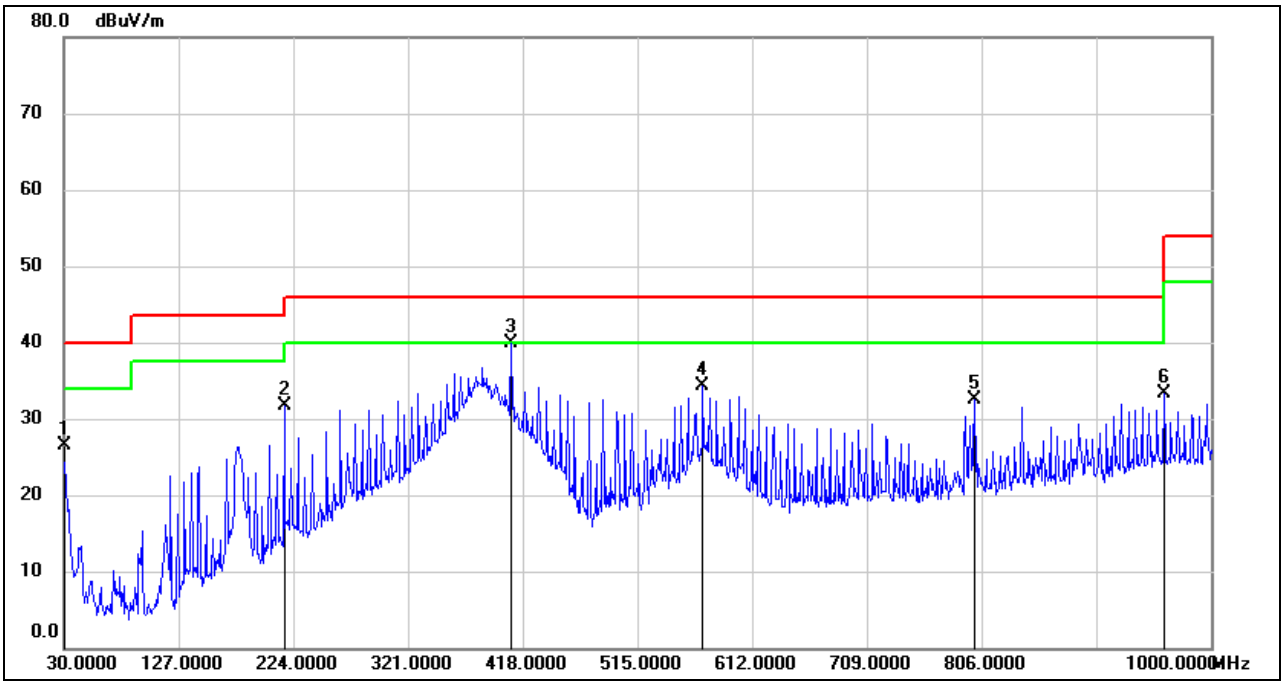
SPURIOUS EMISSIONS (LOW CHANNEL, WORST-CASE CONFIGURATION, HORIZONTAL)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	30.0000	42.64	-16.94	25.70	40.00	-14.30	QP
2	186.1700	48.83	-16.71	32.12	43.50	-11.38	QP
3	263.7700	58.62	-15.80	42.82	46.00	-3.18	QP
4	372.4100	51.92	-13.13	38.79	46.00	-7.21	QP
5	647.8900	40.02	-8.05	31.97	46.00	-14.03	QP
6	947.6200	41.25	-3.47	37.78	46.00	-8.22	QP

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.
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	30.0000	43.37	-16.94	26.43	40.00	-13.57	QP
2	216.2400	48.59	-16.82	31.77	46.00	-14.23	QP
3	408.3000	52.55	-12.57	39.98	46.00	-6.02	QP
4	570.2900	43.68	-9.45	34.23	46.00	-11.77	QP
5	800.1800	38.01	-5.51	32.50	46.00	-13.50	QP
6	960.2300	36.79	-3.52	33.27	54.00	-20.73	QP

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.
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

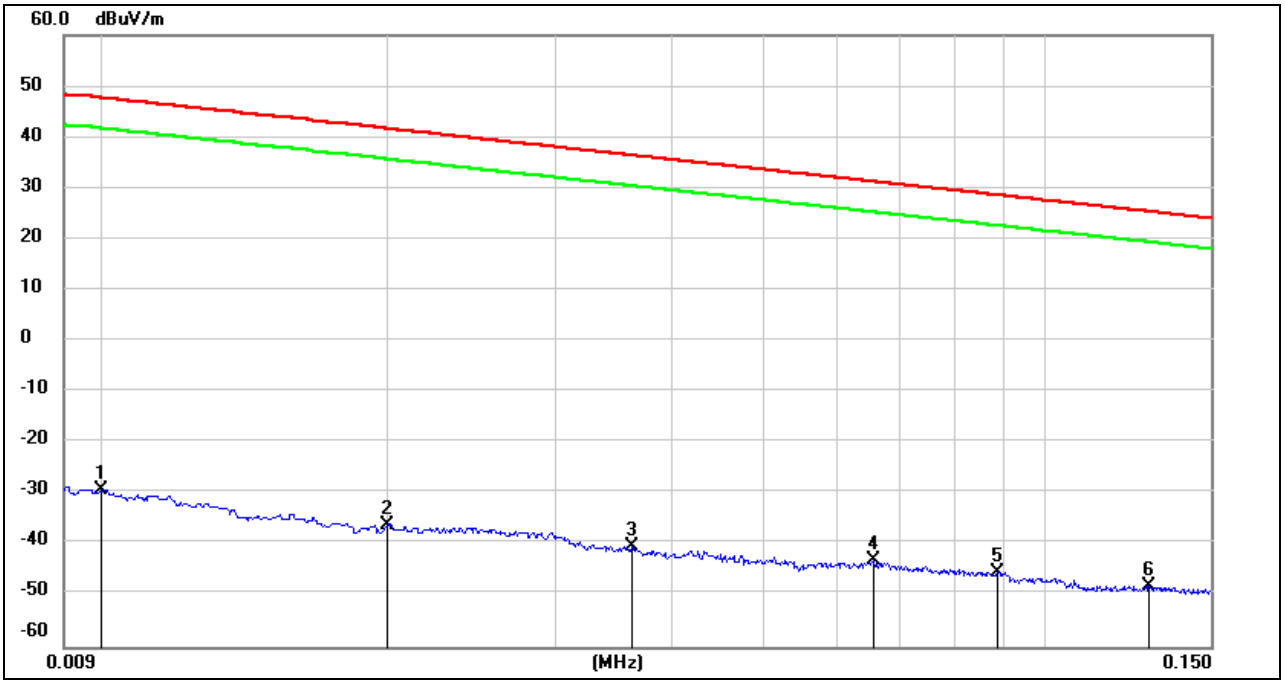
Note: All the test modes has been tested, only the worst data record in the report

8.7. SPURIOUS EMISSIONS BELOW 30M

8.7.1. GFSK MODE

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

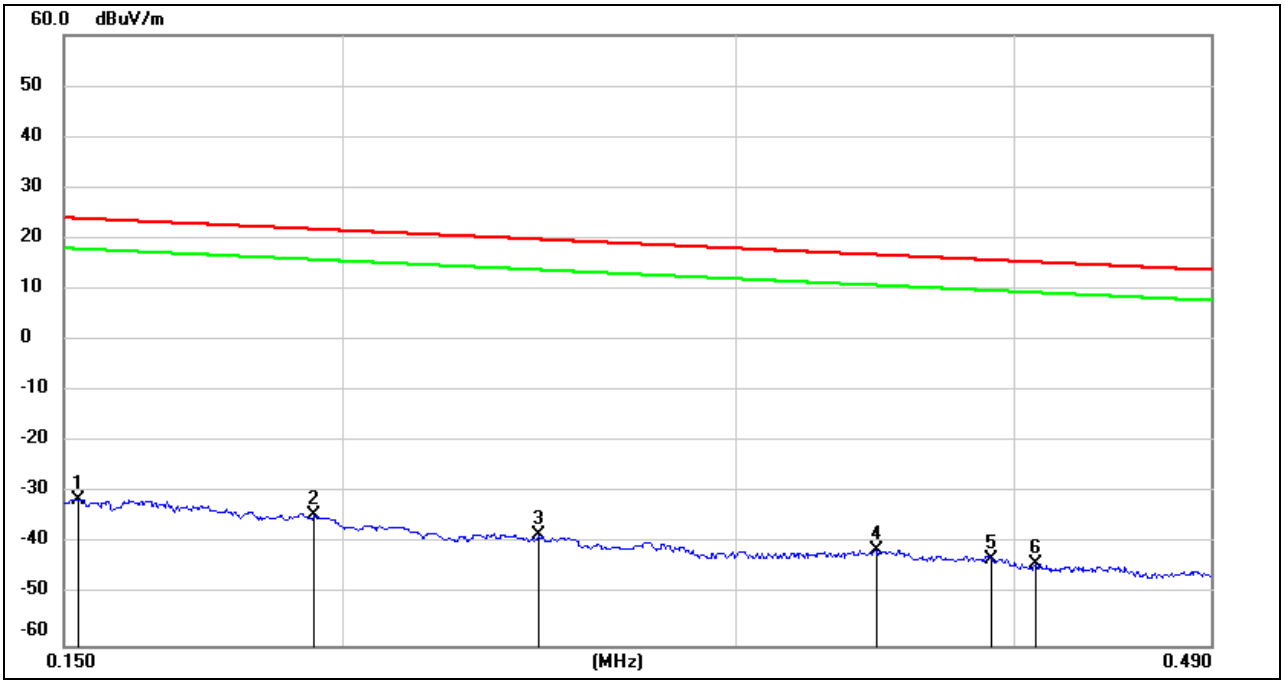
9kHz~ 150kHz



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	0.0100	72.22	-101.40	-29.18	47.60	-76.78	peak
2	0.0200	65.18	-101.34	-36.16	41.58	-77.74	peak
3	0.0362	61.01	-101.42	-40.41	36.43	-76.84	peak
4	0.0656	58.36	-101.55	-43.19	31.26	-74.45	peak
5	0.0889	56.29	-101.71	-45.42	28.63	-74.05	peak
6	0.1290	53.58	-101.70	-48.12	25.40	-73.52	peak

Note: 1. Measurement = Reading Level + Correct Factor.
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.

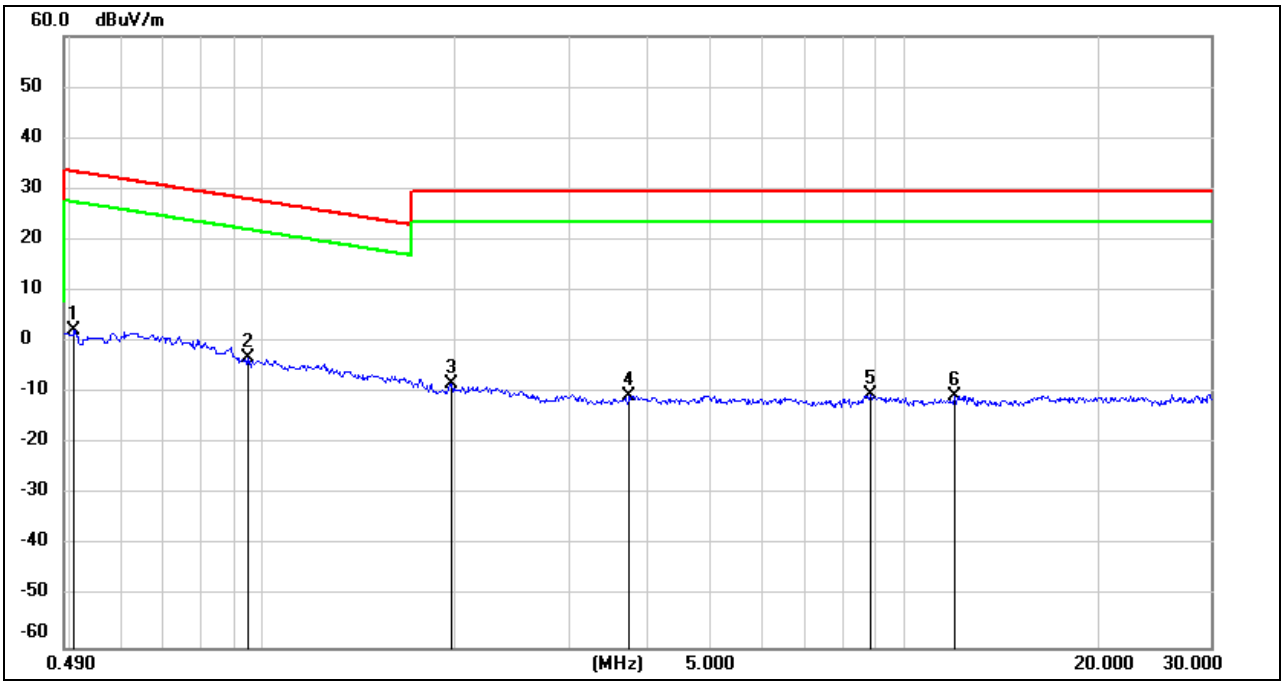
150kHz ~ 0.49MHz



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	0.1524	70.30	-101.63	-31.33	23.94	-55.27	peak
2	0.1942	67.31	-101.70	-34.39	21.84	-56.23	peak
3	0.2449	63.58	-101.79	-38.21	19.82	-58.03	peak
4	0.3467	60.58	-101.90	-41.32	16.80	-58.12	peak
5	0.3911	59.01	-101.95	-42.94	15.76	-58.70	peak
6	0.4091	57.93	-101.97	-44.04	15.36	-59.40	peak

Note: 1. Measurement = Reading Level + Correct Factor.
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.

0.49MHz ~ 30MHz



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	0.5080	64.35	-62.07	2.28	33.49	-31.21	peak
2	0.9465	59.10	-62.23	-3.13	28.08	-31.21	peak
3	1.9681	53.50	-61.83	-8.33	29.54	-37.87	peak
4	3.7360	50.83	-61.40	-10.57	29.54	-40.11	peak
5	8.8704	50.47	-60.96	-10.49	29.54	-40.03	peak
6	12.0282	50.33	-60.89	-10.56	29.54	-40.10	peak

Note: 1. Measurement = Reading Level + Correct Factor.
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.

Note: All test mode has been tested, only the worst data record in the report.

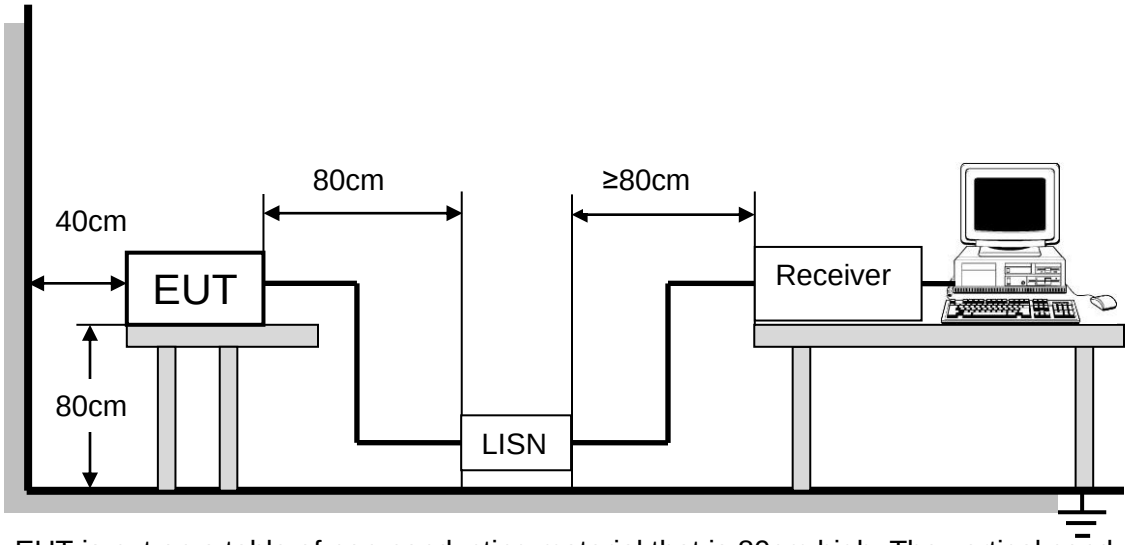
9. AC POWER LINE CONDUCTED EMISSIONS

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.

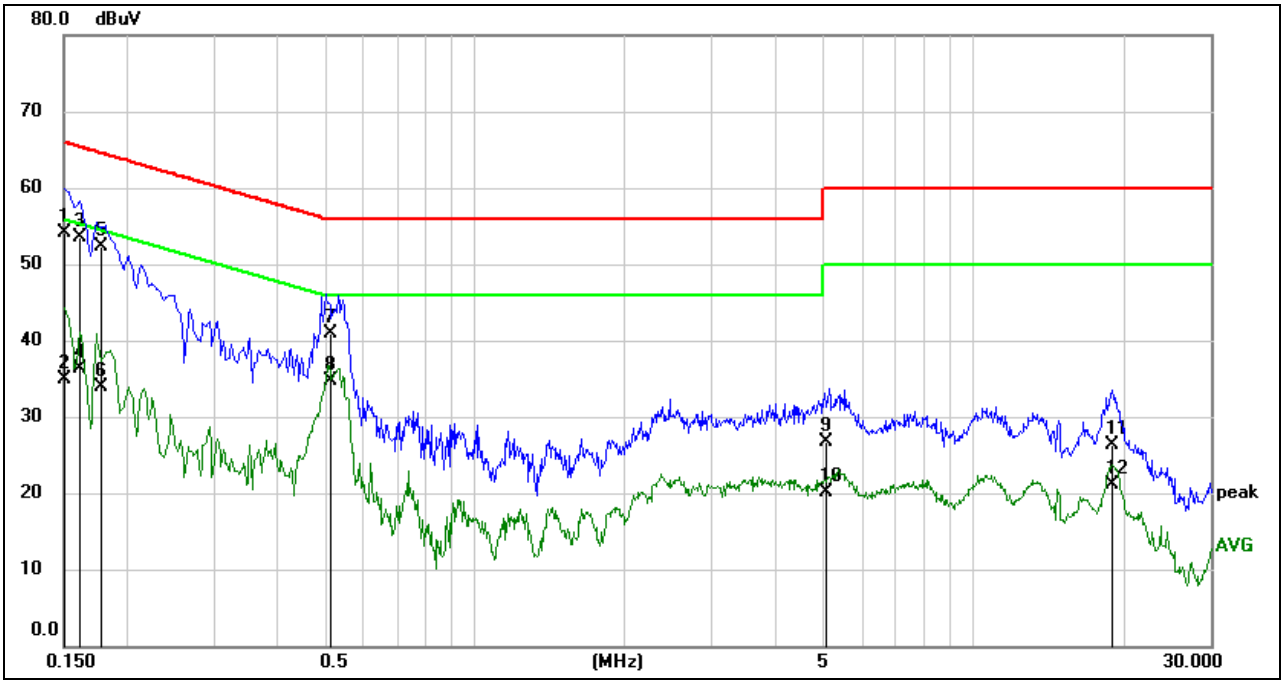
TEST ENVIRONMENT

Temperature	22.8°C	Relative Humidity	51%
Atmosphere Pressure	101kPa	Test Voltage	AC 120V 60Hz

9.1.1. GFSK MODE

TEST RESULTS (LOW CHANNEL, WORST-CASE CONFIGURATION)

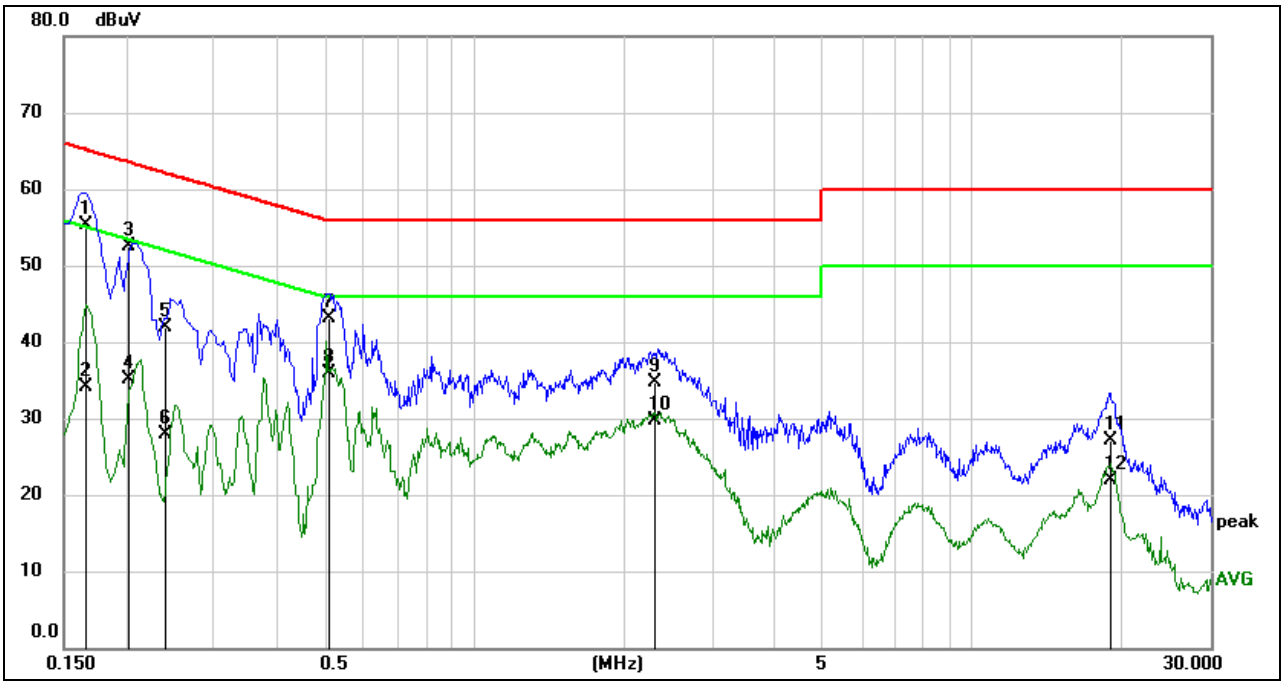
LINE N RESULTS



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1501	44.47	9.60	54.07	65.99	-11.92	QP
2	0.1501	25.37	9.60	34.97	55.99	-21.02	AVG
3	0.1610	43.86	9.60	53.46	65.41	-11.95	QP
4	0.1610	26.77	9.60	36.37	55.41	-19.04	AVG
5	0.1782	42.75	9.60	52.35	64.57	-12.22	QP
6	0.1782	24.33	9.60	33.93	54.57	-20.64	AVG
7	0.5155	31.31	9.60	40.91	56.00	-15.09	QP
8	0.5155	25.10	9.60	34.70	46.00	-11.30	AVG
9	5.1173	17.00	9.67	26.67	60.00	-33.33	QP
10	5.1173	10.53	9.67	20.20	50.00	-29.80	AVG
11	19.0062	16.06	10.18	26.24	60.00	-33.76	QP
12	19.0062	10.85	10.18	21.03	50.00	-28.97	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



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1663	45.66	9.61	55.27	65.14	-9.87	QP
2	0.1663	24.49	9.61	34.10	55.14	-21.04	AVG
3	0.2011	42.88	9.60	52.48	63.57	-11.09	QP
4	0.2011	25.44	9.60	35.04	53.57	-18.53	AVG
5	0.2417	32.31	9.60	41.91	62.04	-20.13	QP
6	0.2417	18.37	9.60	27.97	52.04	-24.07	AVG
7	0.5113	33.51	9.60	43.11	56.00	-12.89	QP
8	0.5113	26.28	9.60	35.88	46.00	-10.12	AVG
9	2.3112	25.14	9.63	34.77	56.00	-21.23	QP
10	2.3112	20.10	9.63	29.73	46.00	-16.27	AVG
11	18.9106	17.00	10.06	27.06	60.00	-32.94	QP
12	18.9106	11.87	10.06	21.93	50.00	-28.07	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 test mode has 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

END OF REPORT