



**FCC 47 CFR PART 15 SUBPART C
CERTIFICATION TEST REPORT**

For

**Car Radio with BT Module
MODEL NUMBER: K216**

FCC ID: RQ9NGIBT

REPORT NUMBER: 4787804393-1

ISSUE DATE: December 30, 2016

Prepared for

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Prepared by

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Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	12/30/2016	Initial Issue	

Summary of Test Results			
Clause	Test Items	FCC/IC Rules	Test Results
1	20dB Bandwidth	FCC 15.247 (a) (1) IC RSS-247 Clause 5.1 (1)	Complied
2	Peak Conducted Output Power	FCC 15.247 (b) (1) IC RSS-247 Clause 5.4 (2)	Complied
3	Carrier Hopping Channel Separation	FCC 15.247 (a) (1) IC RSS-247 Clause 5.1 (2)	Complied
4	Number of Hopping Frequency	15.247 (a) (1) III IC RSS-247 Clause 5.1 (4)	Complied
5	Time of Occupancy (Dwell Time)	15.247 (a) (1) III IC RSS-247 Clause 5.1 (4)	Complied
6	Conducted Bandedge and Spurious	FCC 15.247 (d) IC RSS-247 Clause 5.5	Complied
7	Radiated Bandedge and Spurious	FCC 15.247 (d) FCC 15.209 FCC 15.205 IC RSS-247 Clause 5.5 IC RSS-GEN Clause 8.9	Complied
8	Conducted Emission Test For AC Power Port	FCC 15.207 RSS-GEN Clause 8.8	N/A
9	Antenna Requirement	FCC 15.203 RSS-GEN Clause 8.3	Complied
Remark: N/A is an abbreviation for Not Applicable, and means this item is not applicable for this device.			

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1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name: Yanfeng Visteon Automotive Electronics Co., Ltd

Address: 300 Minolta Road Songjiang County Shanghai, China

Manufacturer Information

Company Name: Yanfeng Visteon Automotive Electronics Co., Ltd

Address: 300 Minolta Road Songjiang County Shanghai, China

EUT Description

Product Name Car Radio with BT Module

Brand Name N/A

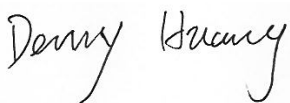
Model Name K216

FCC ID RQ9NGIBT

Date Tested December 29, 2016 ~ December 30, 2016

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	PASS

Tested By:



Denny Huang
Engineer Project Associate
Approved By:



Stephen Guo
Laboratory Manager

Check By:



Shawn Wen
Laboratory Leader

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, RSS-GEN Issue 4, and RSS-247 Issue 1.

3. FACILITIES AND ACCREDITATION

Test Location	Dongguan Dongdian Testing Service Co., Ltd
Address	No. 17, Zongbu Road 2, Songshan Lake Sci&Tech, Dongguan City, Guangdong Province, 523808, China
Accreditation Certificate	<p>Dongguan Dongdian Testing Service Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing. Valid time is until January 31, 2018.</p> <p>Dongguan Dongdian Testing Service Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration 270092, Renewal date March 11, 2015, valid time is until March 11, 2018.</p> <p>The 3m Alternate Test Site of Dongguan Dongdian Testing Service Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 10288A on April 23, 2015, valid time is until April 23, 2018.</p>

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:

PARAMETER	UNCERTAINTY
Bandwidth	1.1%
Peak Output Power(Conducted)(Spectrum analyzer)	0.86dB(10 MHz ≤ f < 3.6GHz);
	1.38dB(3.6GHz ≤ f < 8GHz)
Peak Output Power(Conducted)(Power Sensor)	0.74dB
Dwell Time	0.6%
Conducted spurious emissions	0.86dB(10 MHz ≤ f < 3.6GHz);
	1.40dB(3.6GHz ≤ f < 8GHz)
	1.66dB(8GHz ≤ f < 22GHz)
Uncertainty for radio frequency (RBW<20KHz)	3×10 ⁻⁸
Temperature	0.4℃
Humidity	2%
Uncertainty for Radiation Emission test (30MHz-1GHz)	4.70 dB (Antenna Polarize: V)
	4.84 dB (Antenna Polarize: H)
Uncertainty for Radiation Emission test (1GHz-18GHz)	4.10dB(1-6GHz)
	4.40dB (6GHz-18Gz)
Uncertainty for Power line conduction emission test	3.32dB (150KHz-30MHz)
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

Equipment	Car Radio with BT Module	
Model Name	K216	
Product Description	Operation Frequency	2402 MHz ~ 2480 MHz
	Modulation Type	Data Rate
	GFSK	1Mbps
	$\pi/4$ -DQPSK	2Mbps
	8-DPSK	3Mbps
Power Supply	DC 12V	
Battery	N/A	
Bluetooth Version	BT 2.1+EDR	
NOTE:	Test with GFSK, $\pi/4$ QPSK, 8-DPSK, the worst case is GFSK and $\pi/4$ QPSK Mode and only worse case is reported	

5.2. MAXIMUM OUTPUT POWER

Frequency Range (MHz)	Number of Transmit Chains (NTX)	Bluetooth Mode	Frequency (MHz)	Channel Number	Max PK Conducted Power (dBm)
2400-2483.5	1	GFSK	2402-2480	0-78[79]	4.08
2400-2483.5	1	8-DPSK	2402-2480	0-78[79]	5.56

5.3. PACKET TYPE CONFIGURATION

Test Mode	Packet Type	Setting
GFSK	DH1	27
	DH3	183
	DH5	339
$\pi/4$ -DQPSK	2-DH1	54
	2-DH3	367
	2-DH5	679
8-DPSK	3-DH1	83
	3-DH3	552
	3-DH5	1021

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 00, CH 39, CH 78	Low, Middle, High
8-DPSK	CH 00, CH 39, CH 78	Low, Middle, High

5.6. THE WORSE CASE POWER SETTING PARAMETER

The Worse Case Power Setting Parameter under 2400 ~ 2483.5MHz Band				
Test Software Version		ttermpro		
Modulation Type	Transmit Antenna Number	Test Channel		
		CH 00	CH 39	CH 78
GFSK	1	7	7	7
8-DPSK	1	7	7	7

5.7. DESCRIPTION OF AVAILABLE ANTENNAS

Ant.	Frequency (MHz)	Antenna Type	Antenna Gain (dBi)
1	2402-2480	PCB Antenna	-1

Test Mode	Transmit and Receive Mode	Description
GFSK	<input checked="" type="checkbox"/> 1TX, 1RX	Chain 1 can be used as transmitting/receiving antenna.
8-DPSK	<input checked="" type="checkbox"/> 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
EDR	FHSS	8-DPSK	3Mbit/s

5.9. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	FCC DOC
1	Laptop	ThinkPad	Latitude D610	YES

I/O CABLES

Cable No	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
1	USB out 1	USB	Unshielded	0.8	DC 5V, 2A

ACCESSORY

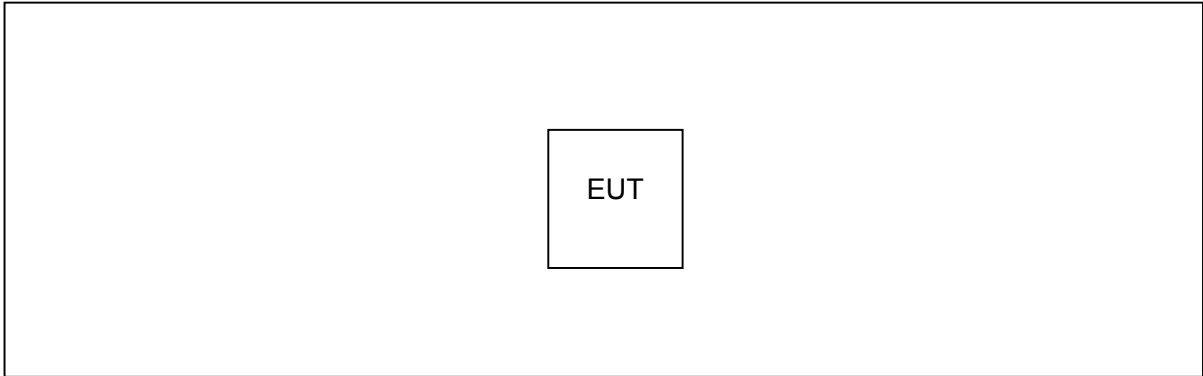
Item	Accessory	Brand Name	Model Name	Description
1	N/A	N/A	N/A	N/A

Note: The EUT has no accessory.

TEST SETUP

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

SETUP DIAGRAM FOR TESTS



5.10. MEASURING INSTRUMENT AND SOFTWARE USED

Instrument (Conducted for RF Port)						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
<input checked="" type="checkbox"/>	Spectrum Analyzer	Agilent	E4447A	MY50180031	2016/07/06	1 Year
<input checked="" type="checkbox"/>	Spectrum analyzer	R&S	FSU26	1166.1660.26	2016/10/16	1Year
<input checked="" type="checkbox"/>	Power Sensor	Agilent	U2021XA	MY55150010	2016/04/18	1Year
<input checked="" type="checkbox"/>	Power Sensor	Agilent	U2021XA	MY55150011	2016/04/19	1Year
<input checked="" type="checkbox"/>	Attenuator	Mini-Circuits	BW-S10W2	101109	2016/08/18	1Year
<input checked="" type="checkbox"/>	RF Cable	Micable	C10-01-01-1	100309	2016/08/18	1Year
<input checked="" type="checkbox"/>	Test Software	JS Tonscend	JS1120-2	Ver.2.5	N/A	N/A
<input checked="" type="checkbox"/>	USB Data acquisition	Agilent	U2531A	TW55043503	N/A	N/A
<input checked="" type="checkbox"/>	Auto control Unit	JS Tonscend	JS0806-2	158060010	N/A	N/A
Instrument (Radiated Tests)						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Expired date
<input checked="" type="checkbox"/>	EMI Test Receiver	R&S	ESU8	100316	2016/10/16	1 Year
<input checked="" type="checkbox"/>	Spectrum analyzer	R&S	FSU26	1166.1660.26	2016/10/16	1 Year
<input checked="" type="checkbox"/>	Trilog Broadband Antenna	Schwarzbeck	VULB9163	9163-462	2016/10/27	1 Year
<input checked="" type="checkbox"/>	Active Loop antenna	Schwarzbeck	FMZB-1519	1519-038	2016/10/27	1 Year
<input checked="" type="checkbox"/>	Double Ridged Horn Antenna	R&S	HF907	100276	2016/10/12	1 Year
<input checked="" type="checkbox"/>	Horn Antenna	ETS-LINDGERN	3160	SEL0076	2016/10/16	1 Year
<input checked="" type="checkbox"/>	Pre-amplifier	A.H.	PAM-0118	360	2016/10/16	1 Year
<input checked="" type="checkbox"/>	Pre-amplifier	Compliance Directions Systems Inc.	PAP-0126	SEL0168	2016/10/16	1 Year
<input checked="" type="checkbox"/>	RF Cable	HUBSER	CP-X2	W11.03	2016/10/16	1 Year
<input checked="" type="checkbox"/>	RF Cable	HUBSER	CP-X1	W12.02	2016/10/16	1 Year
<input checked="" type="checkbox"/>	MI Cable	HUBSER	C10-01-01-1M	1091629	2016/10/16	1 Year
<input checked="" type="checkbox"/>	Test software	Audix	E3	V 6.11111b	N/A	N/A
Instrument (Line Conducted Emission (AC Main))						

Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Expired date
<input checked="" type="checkbox"/>	Test Receiver	R&S	ESU8	100316	2016/10/16	1 Year
<input checked="" type="checkbox"/>	LISN 1	R&S	ENV216	101109	2016/10/16	1 Year
<input checked="" type="checkbox"/>	LISN 2	R&S	ESH2-Z5	100309	2016/10/16	1 Year
<input checked="" type="checkbox"/>	Pulse Limiter	R&S	ESH3-Z2	101242	2016/10/16	1 Year
<input checked="" type="checkbox"/>	CE Cable 1	HUBSER	ESU8/RF2	W10.01	2016/10/16	1 Year
<input checked="" type="checkbox"/>	Test software	Audix	E3	V 6.11111b	N/A	N/A

6. MEASUREMENT METHODS

No.	Test Item	KDB Name
1	20 dB Bandwidth	FCC Public Notice DA 00-705
2	99% Bandwidth	ANSI C63.10-2013
3	Peak Output Power	FCC Public Notice DA 00-705
4	Power Spectral Density	FCC Public Notice DA 00-705
5	Out-of-band emissions in non-restricted bands	FCC Public Notice DA 00-705
6	Out-of-band emissions in restricted bands	FCC Public Notice DA 00-705
7	Band-edge	FCC Public Notice DA 00-705

ANTENNA PORT TEST RESULTS

6.1. 20 dB BANDWIDTH AND 99% BANDWIDTH

LIMITS

FCC Part15 (15.247) , Subpart C IC RSS-247 ISSUE 1			
Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.247 (a) (1) IC RSS-247 Clause 5.1 (1)	20dB Bandwidth	N/A	2400-2483.5
RSS-Gen Clause 6.6	99% Bandwidth	N/A	2400-2483.5

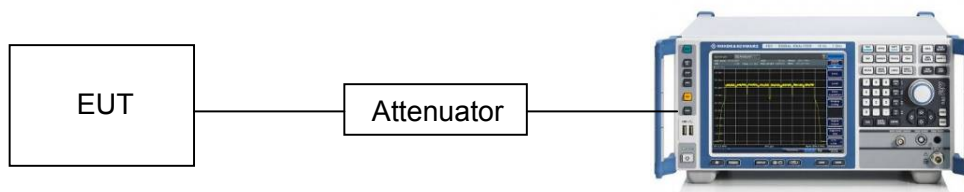
TEST PROCEDURE

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

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	$\geq 1\%$ of the 20 dB bandwidth
VBW	\geq 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 20 dB relative to the maximum level measured in the fundamental emission.

TEST SETUP



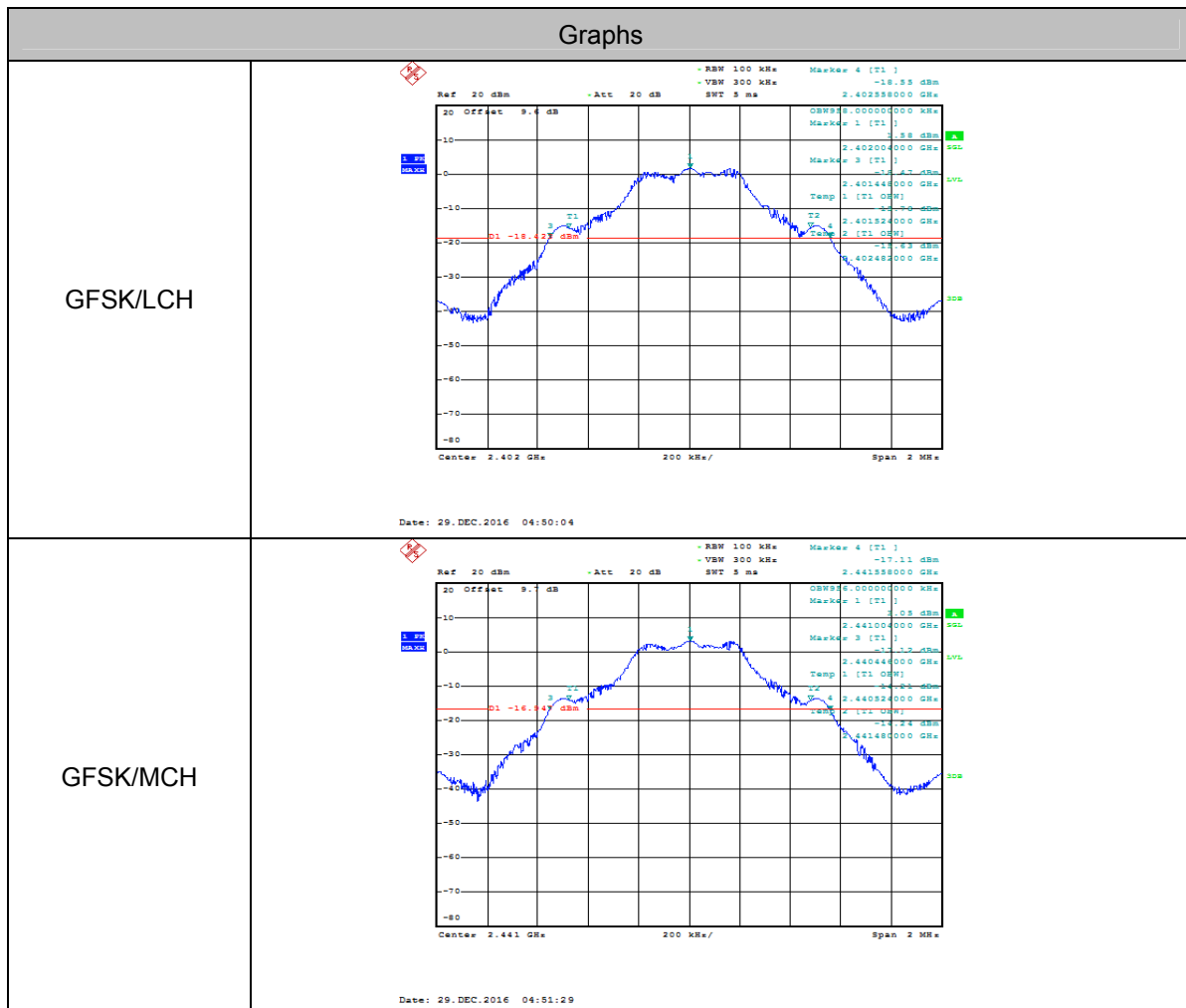
TEST CONDITIONS

Temperature: 26.6°C
 Relative Humidity: 58%
 Test Voltage: DC 12V

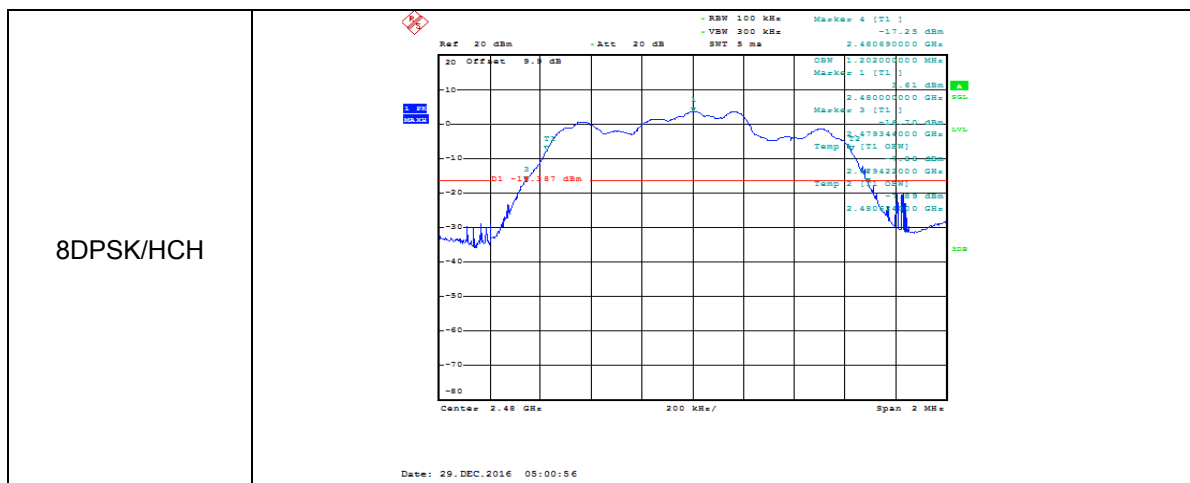
RESULTS

Mode	Channel.	20dB Bandwidth [MHz]	99% OBW [MHz]	Verdict
GFSK	LCH	1.110	0.958	PASS
GFSK	MCH	1.112	0.956	PASS
GFSK	HCH	1.110	0.954	PASS
8-DPSK	LCH	1.366	1.200	PASS
8-DPSK	MCH	1.358	1.200	PASS
8-DPSK	HCH	1.346	1.202	PASS

Test Graph



<p>GFSK/HCH</p>	<p>Date: 29.DEC.2016 04:52:45</p>
<p>8DPSK/LCH</p>	<p>Date: 29.DEC.2016 04:54:36</p>
<p>8DPSK/MCH</p>	<p>Date: 29.DEC.2016 04:57:43</p>



6.2. PEAK CONDUCTED OUTPUT POWER

LIMITS

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

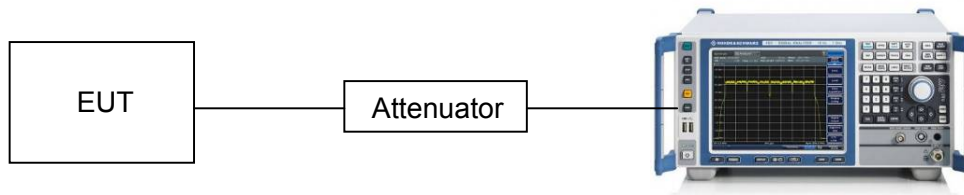
TEST PROCEDURE

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

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	> the 20 dB bandwidth of the emission being measured (e.g. 1 MHz for BT)
VBW	≥RBW
Span	approximately 5 times the 20 dB bandwidth, centered on a hopping channel
Trace	Max hold
Sweep time	Auto couple

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

TEST SETUP



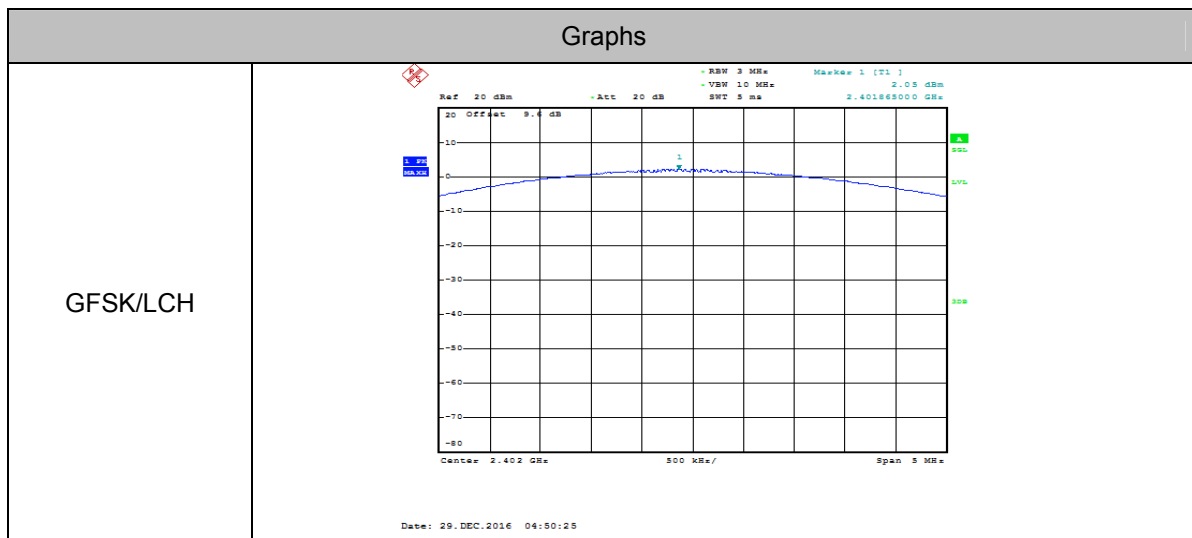
TEST CONDITIONS

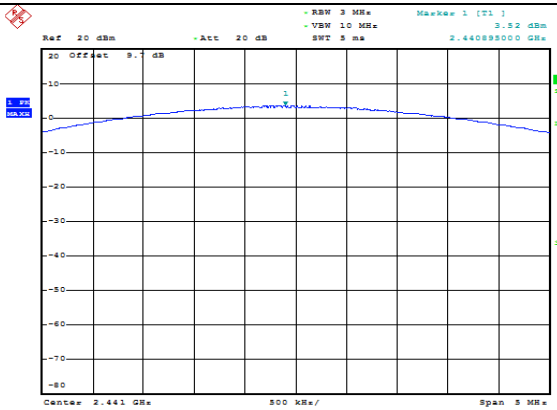
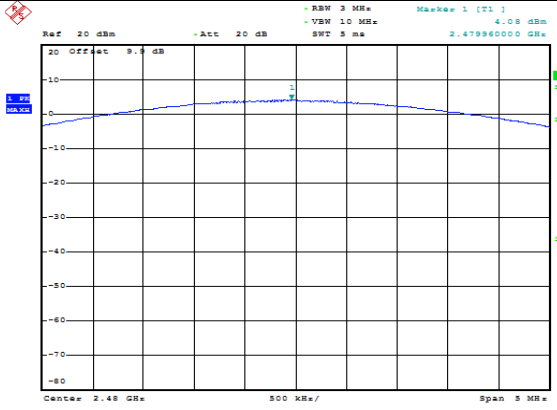
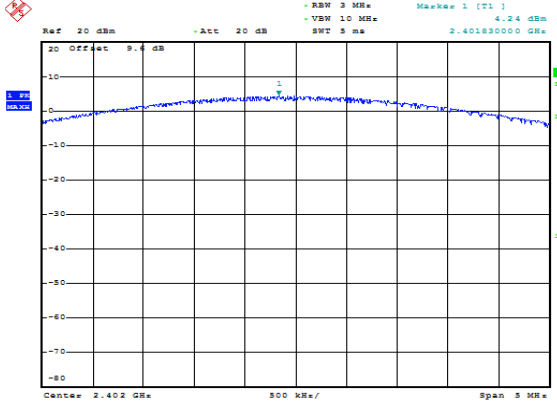
Temperature: 26.6°C
 Relative Humidity: 58%
 Test Voltage: DC 12V

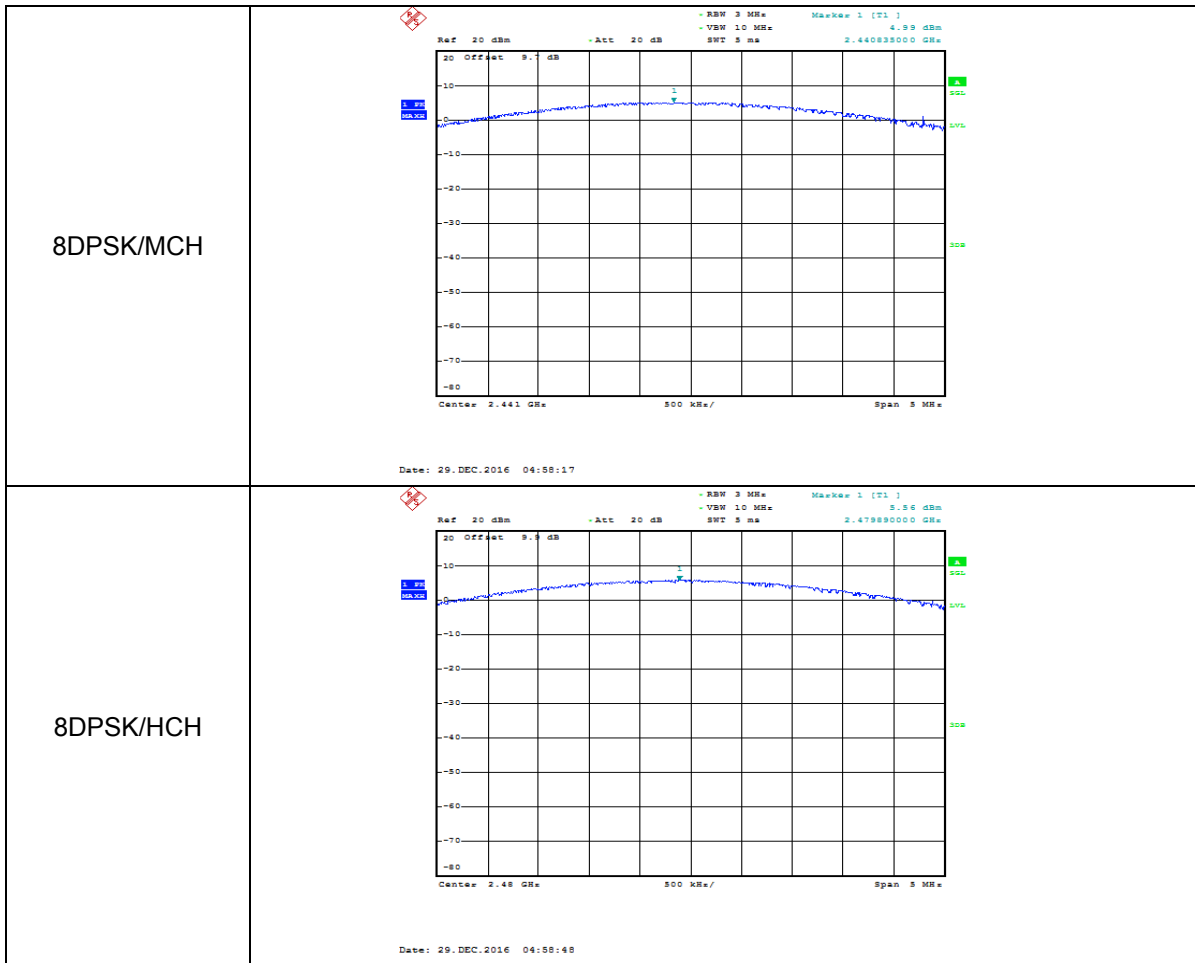
RESULTS

Mode	Channel.	Maximum Peak Output Power [dBm]	Verdict
GFSK	LCH	2.050	PASS
GFSK	MCH	3.520	PASS
GFSK	HCH	4.080	PASS
8-DPSK	LCH	4.240	PASS
8-DPSK	MCH	4.990	PASS
8-DPSK	HCH	5.560	PASS

Test Graph



<p>GFSK/MCH</p>	 <p>Ref 20 dBm -Att 20 dB -RBW 3 MHz -VBW 10 MHz -SWT 5 ms -Mask# 1 (T1) 3.52 dBm 2.440895000 GHz</p> <p>20 Offset 9.1 dB</p> <p>Center 2.441 GHz 500 kHz/ Span 5 MHz</p> <p>Date: 29.DEC.2016 04:52:03</p>
<p>GFSK/HCH</p>	 <p>Ref 20 dBm -Att 20 dB -RBW 3 MHz -VBW 10 MHz -SWT 5 ms -Mask# 1 (T1) 4.08 dBm 2.478960000 GHz</p> <p>20 Offset 9.4 dB</p> <p>Center 2.478 GHz 500 kHz/ Span 5 MHz</p> <p>Date: 29.DEC.2016 04:59:02</p>
<p>8DPSK/LCH</p>	 <p>Ref 20 dBm -Att 20 dB -RBW 3 MHz -VBW 10 MHz -SWT 5 ms -Mask# 1 (T1) 4.24 dBm 2.401830000 GHz</p> <p>20 Offset 9.4 dB</p> <p>Center 2.402 GHz 500 kHz/ Span 5 MHz</p> <p>Date: 29.DEC.2016 04:56:07</p>



6.3. CARRIER HOPPING CHANNEL SEPARATION

LIMITS

FCC Part15 (15.247) , Subpart C IC RSS-247 ISSUE 1			
Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.247 (a) (1) IC RSS-247 Clause 5.1 (2)	Carrier Hopping Channel Separation	25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.	2400-2483.5

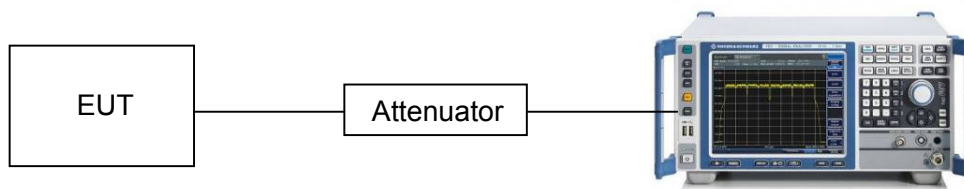
TEST PROCEDURE

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

Center Frequency	The centre frequency of the channel under test
Span	wide enough to capture the peaks of two adjacent channels
Detector	Peak
RBW	$\geq 1\%$ of the span
VBW	\geq 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. The limit is specified in one of the subparagraphs of this Section. Submit this plot.

TEST SETUP



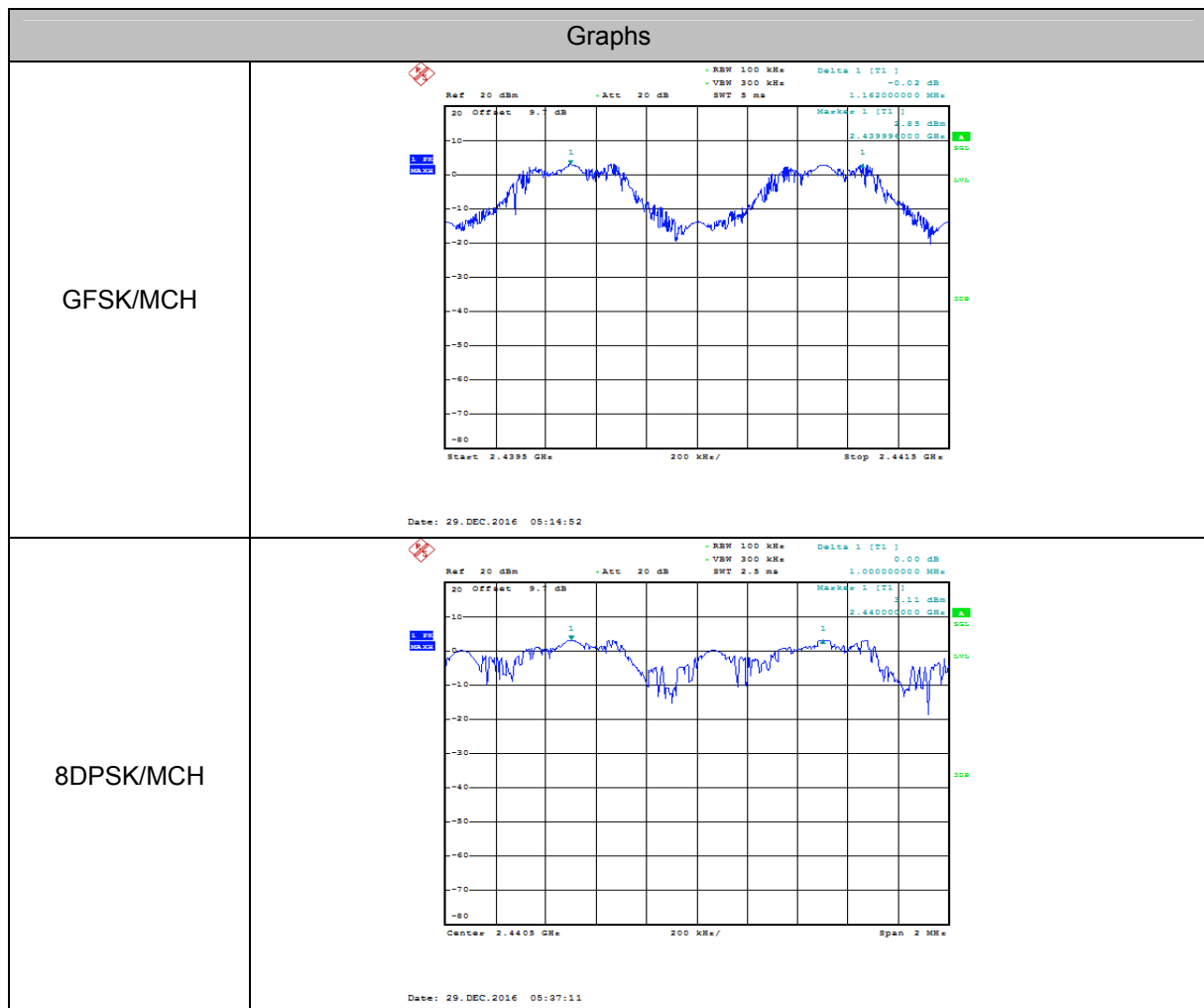
TEST CONDITIONS

Temperature: 28°C
 Relative Humidity: 60%
 Test Voltage: DC 12V

RESULTS

Mode	Channel.	Carrier Frequency Separation [MHz]	Verdict
GFSK	MCH	1.162	PASS
8-DPSK	MCH	1.000	PASS

Test Graph



6.4. NUMBER OF HOPPING FREQUENCY

LIMITS

FCC Part15 (15.247) , Subpart C IC RSS-247 ISSUE 1		
Section	Test Item	Limit
15.247 (a) (1) III IC RSS-247 Clause 5.1 (4)	Number of Hopping Frequency	at least 15 hopping channels

TEST PROCEDURE

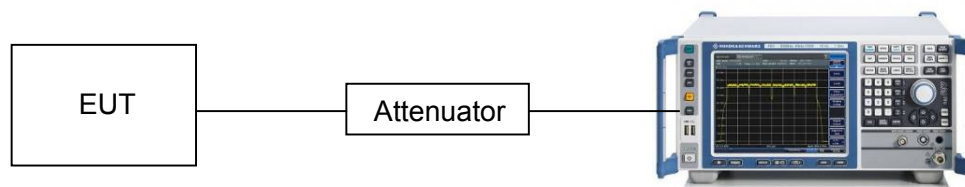
Connect the EUT to the spectrum analyser and use the following settings:

Detector	Peak
RBW	1% of the span
VBW	\geq 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.

TEST SETUP



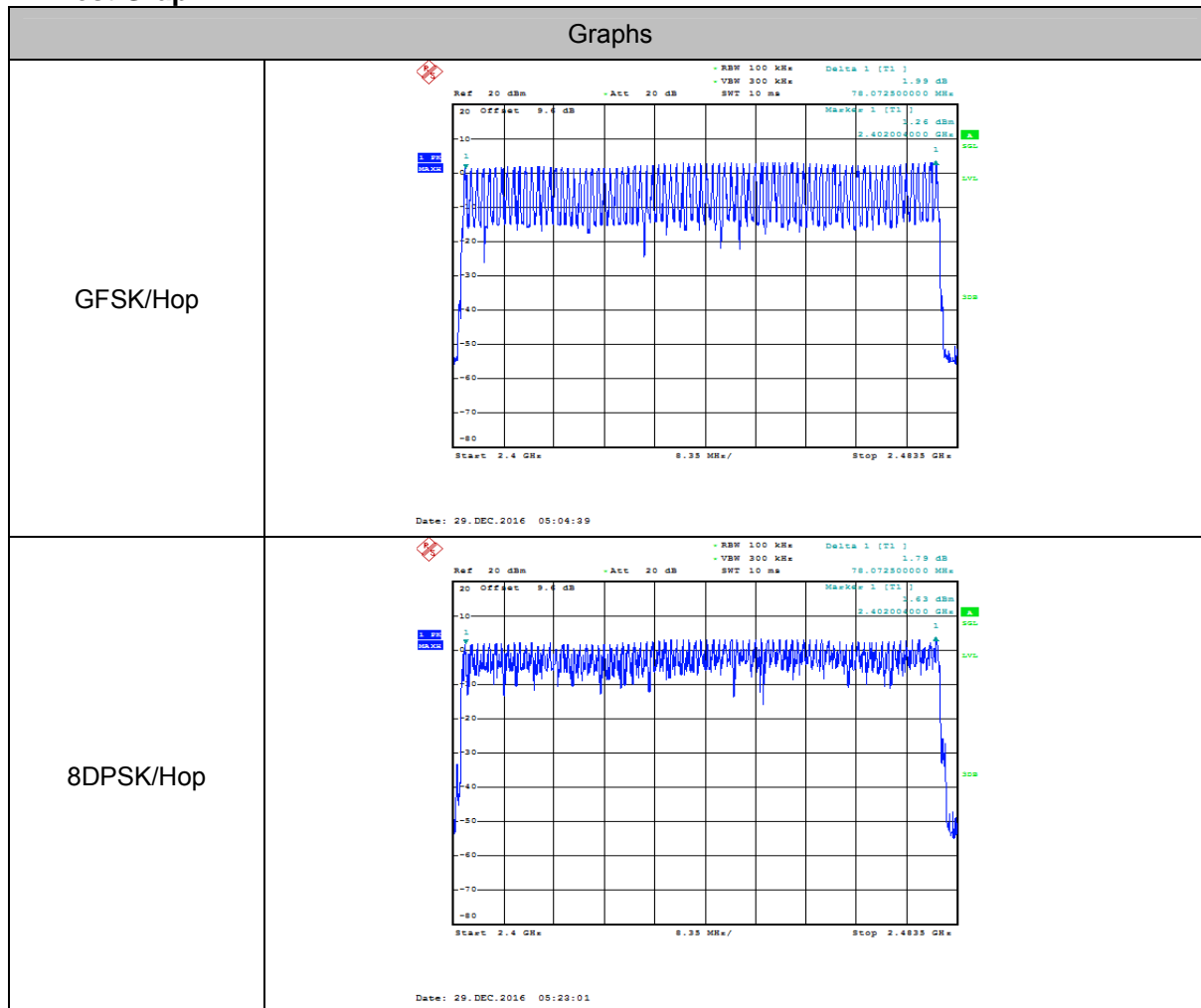
TEST CONDITIONS

Temperature: 26.6°C
 Relative Humidity: 58%
 Test Voltage: DC 12V

RESULTS

Mode	Channel.	Number of Hopping Channel	Verdict
GFSK	Hop	79	PASS
8-DPSK	Hop	79	PASS

Test Graph



6.5. TIME OF OCCUPANCY (DWELL TIME)

LIMITS

FCC Part15 (15.247) , Subpart C IC RSS-247 ISSUE 1		
Section	Test Item	Limit
15.247 (a) (1) III IC RSS-247 Clause 5.1 (4)	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.

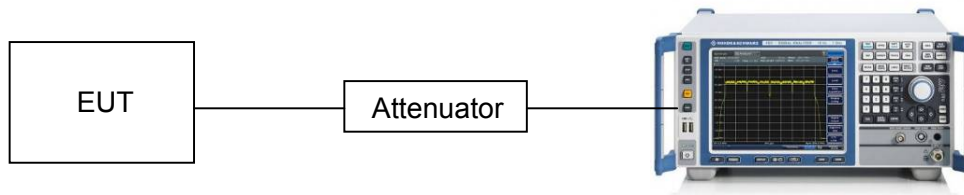
TEST PROCEDURE

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

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	1 MHz
VBW	≥RBW
Span	zero span
Trace	Max hold
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
 - 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)

TEST SETUP



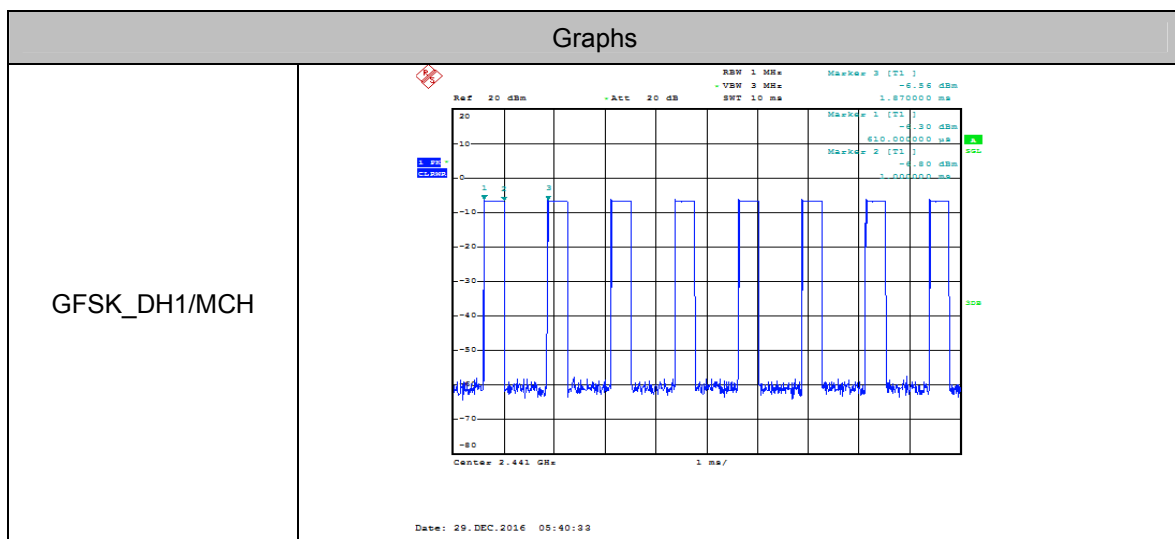
TEST CONDITIONS

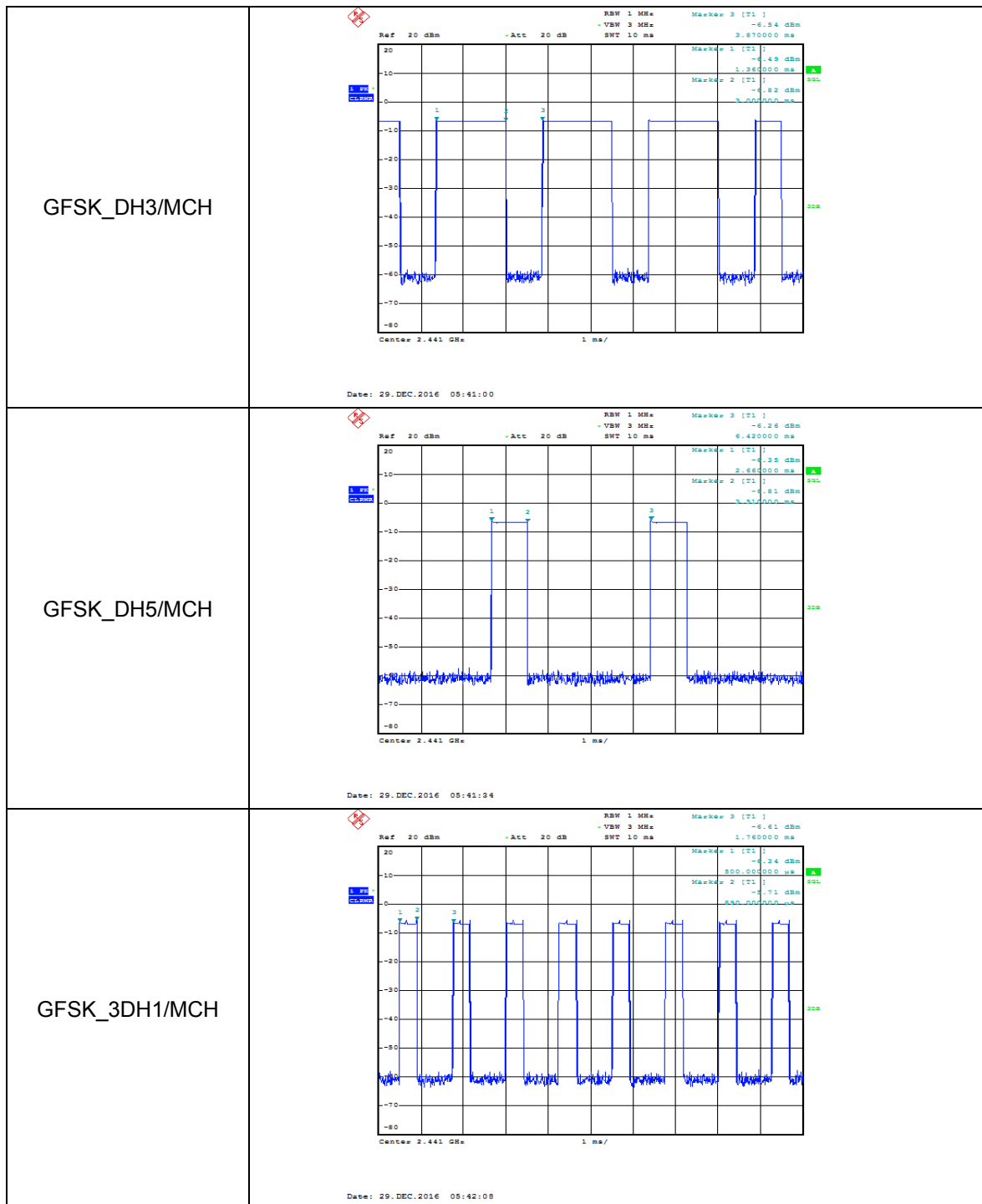
Temperature: 28°C
 Relative Humidity: 60%
 Test Voltage: DC 12V

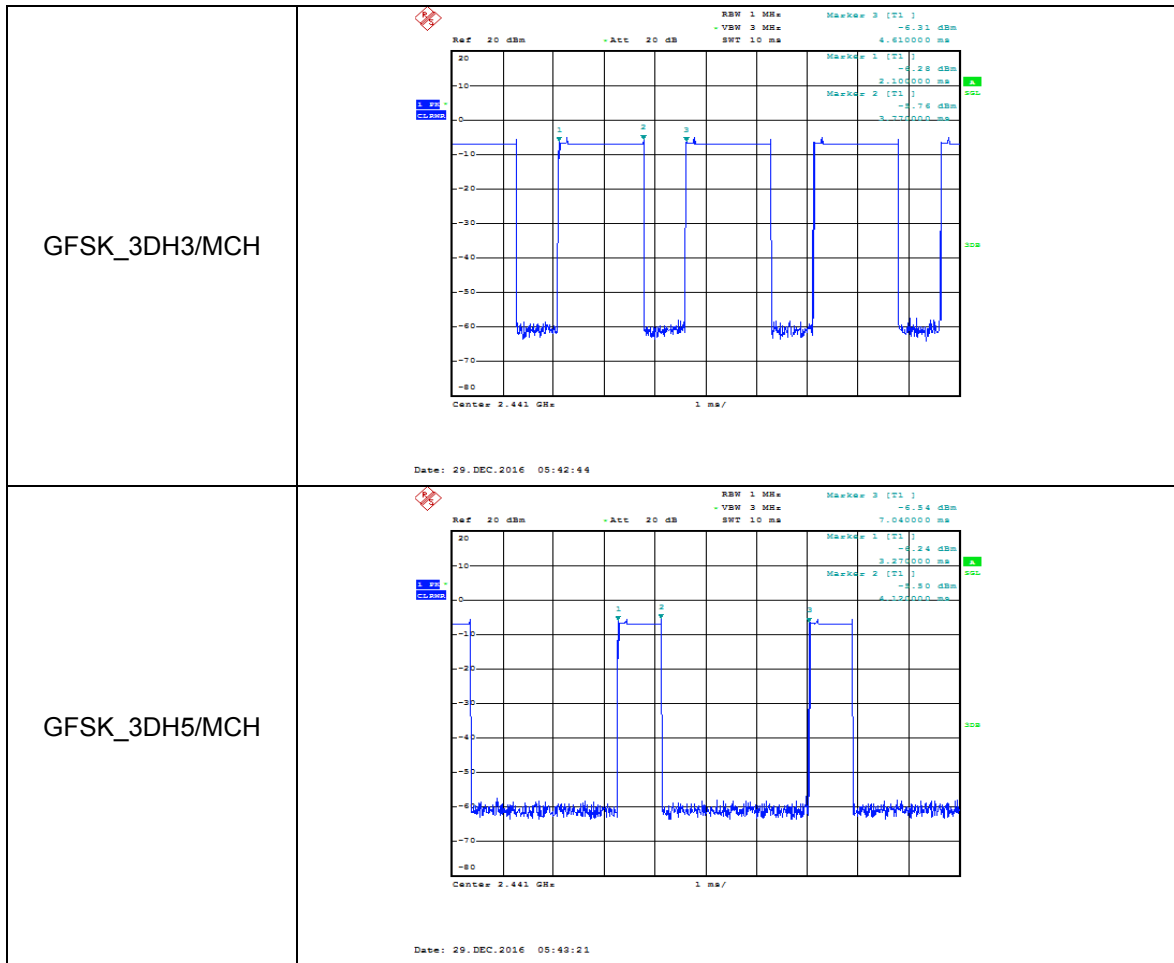
RESULTS

Mode	Packet	Channel	Burst Width [ms/hop/ch]	Total Hops[hop*ch]	Dwell Time[s]	Verdict
Tx mode	DH1	MCH	0.39	320	0.125	PASS
Tx mode	DH3	MCH	1.64	160	0.262	PASS
Tx mode	DH5	MCH	0.85	106.7	0.091	PASS
Tx mode	3DH1	MCH	0.39	320	0.125	PASS
Tx mode	3DH3	MCH	1.67	160	0.267	PASS
Tx mode	3DH5	MCH	0.85	106.7	0.091	PASS

Test Graph







6.6. CONDUCTED BANDEGE AND SPURIOUS EMISSIONS

LIMITS

FCC Part15 (15.247) , Subpart C IC RSS-247 ISSUE 1		
Section	Test Item	Limit
FCC §15.247 (d) IC RSS-247 5.5	Conducted Bandedge and Spurious Emissions	at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power

TEST PROCEDURE

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

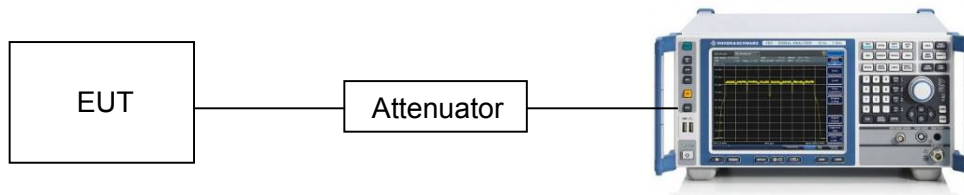
Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	100K
VBW	$\geq 3 \times \text{RBW}$
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple

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	100K
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.

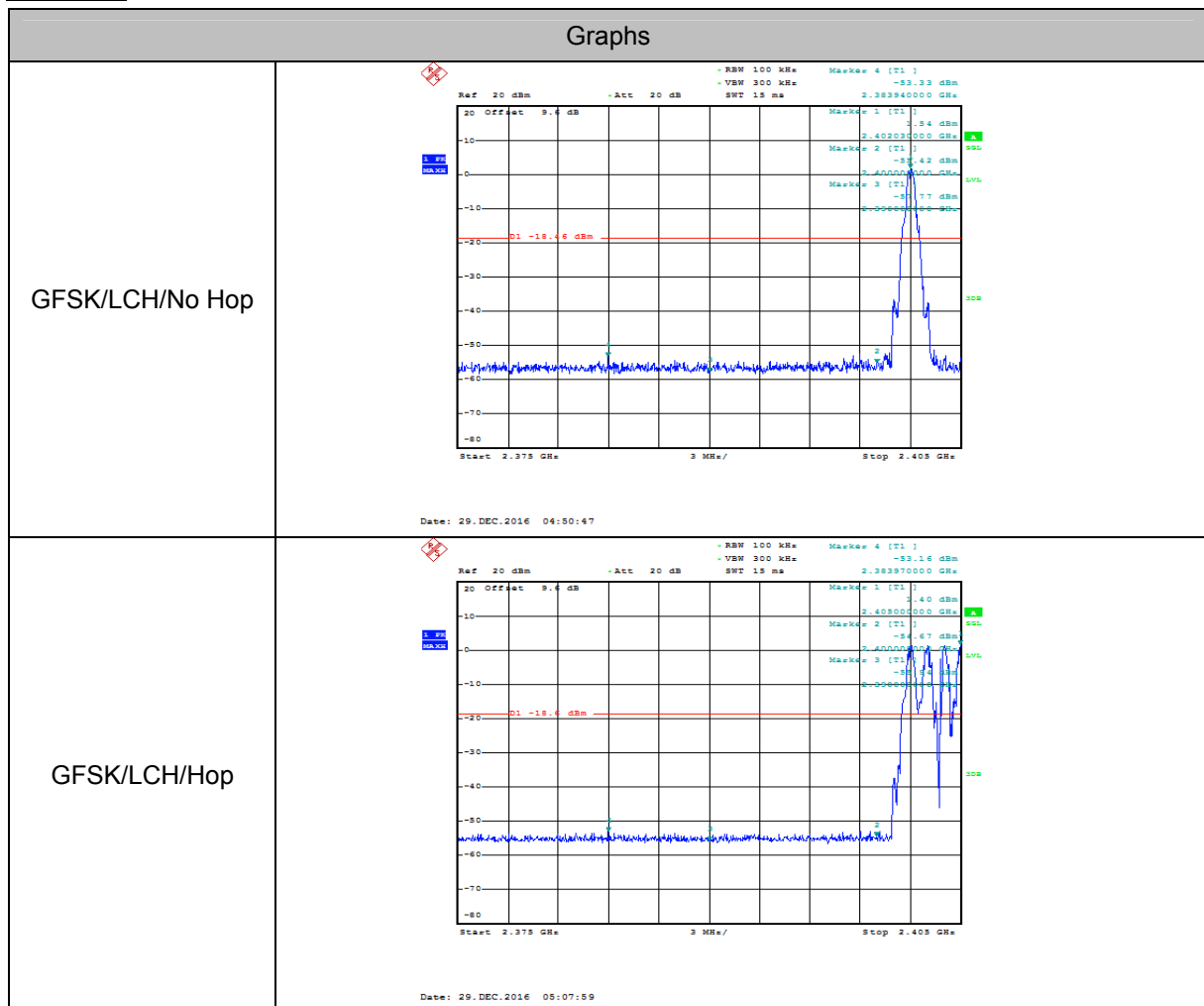
TEST SETUP



TEST CONDITIONS

Temperature: 26.6°C
 Relative Humidity: 58%
 Test Voltage: DC 12V

RESULTS



<p>GFSK/HCH/No Hop</p>	<p>Date: 29. DEC. 2016 04:59:24</p>
<p>GFSK/HCH/Hop</p>	<p>Date: 29. DEC. 2016 05:11:34</p>
<p>8DPSK/LCH/No Hop</p>	<p>Date: 29. DEC. 2016 04:56:29</p>

<p>8DPSK/LCH/Hop</p>	<p>Date: 29 DEC 2016 05:26:54</p>
<p>8DPSK/HCH/No Hop</p>	<p>Date: 29 DEC 2016 04:59:29</p>
<p>8DPSK/HCH/Hop</p>	<p>Date: 29 DEC 2016 05:39:45</p>

7. RADIATED TEST RESULTS

7.1. LIMITS AND PROCEDURE

LIMITS

Please refer to FCC §15.205 and §15.209

Please refer to IC RSS-GEN Clause 8.9 (Transmitter)

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

Radiation Disturbance Test Limit for FCC (Above 1G)

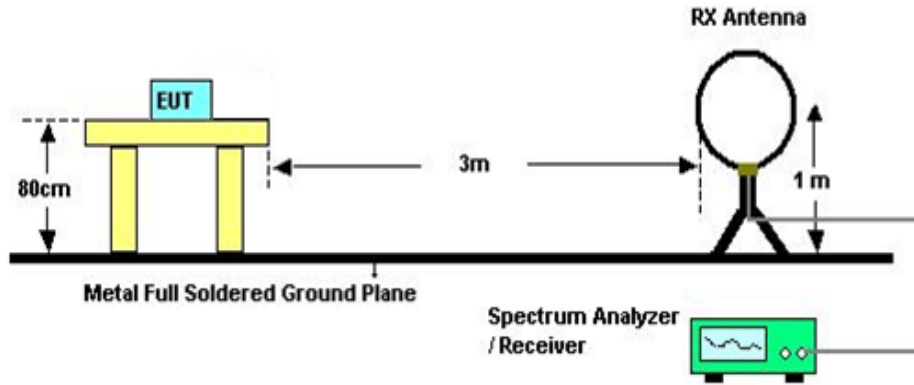
Frequency (MHz)	dB(uV/m) (at 3 meters)	
	Peak	Average
Above 1000	74	54

TEST CONDITIONS

Temperature: 22.2°C
 Relative Humidity: 61.2%
 Test Voltage: DC 12V

TEST SETUP AND PROCEDURE

Below 30MHz

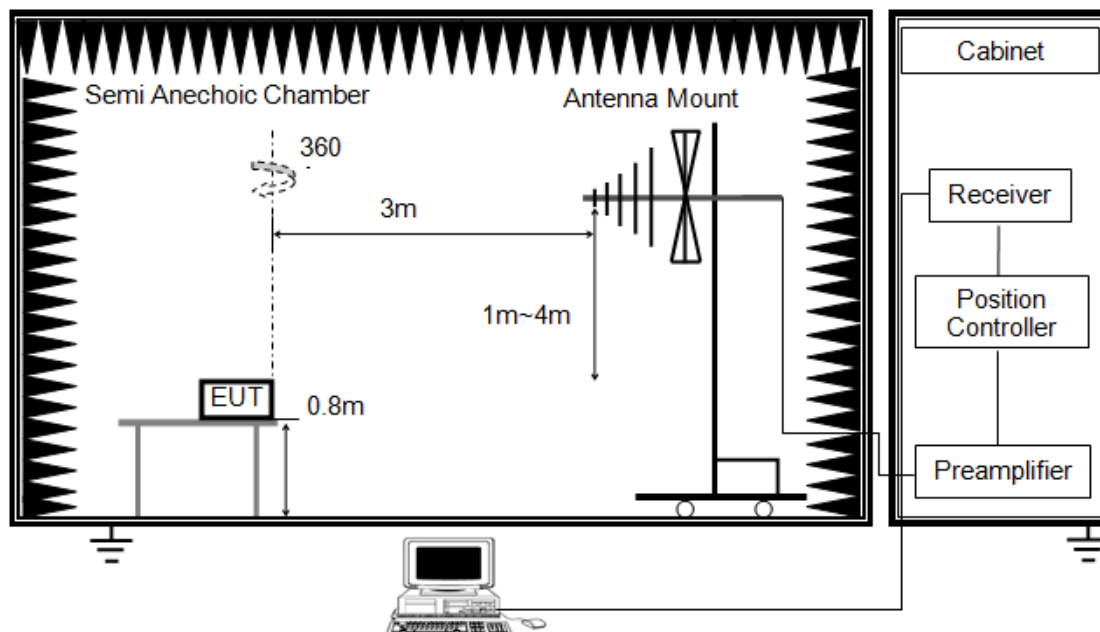


The setting of the spectrum analyser

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
Detector	Peak/QP/ Average
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 and vertical polarizations of the antenna are set to make the measurement.
3. The EUT was placed on a turntable with 0.8 meter 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. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
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. For the actual test configuration, please refer to the related item in this test report (Photographs of the Test Configuration)

Below 1G

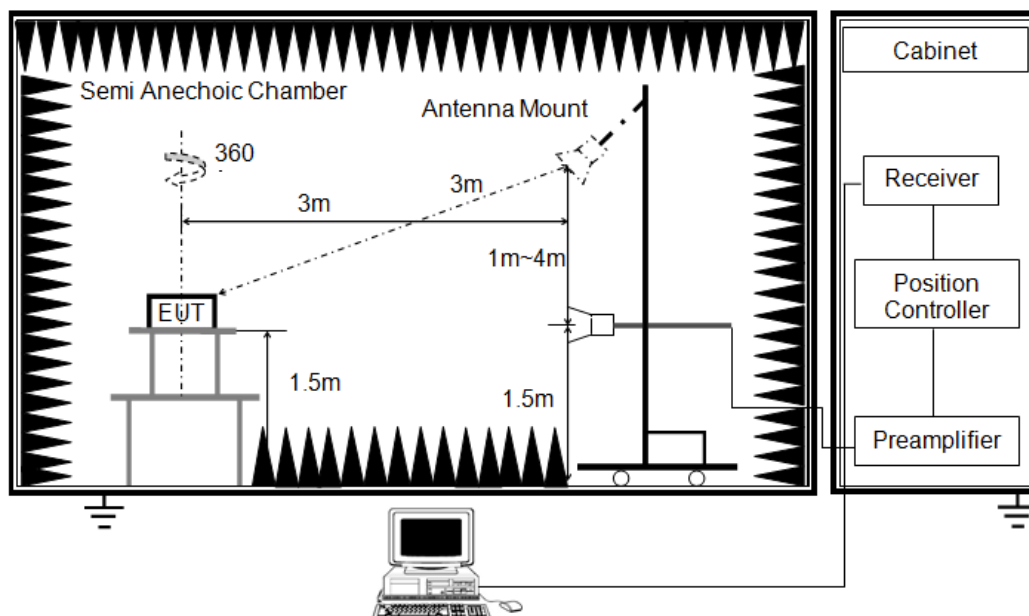


The setting of the spectrum analyser

RBW	120KHz
VBW	300KHz
Sweep	Auto
Detector	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 0.8 meter 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. Corrected Reading: $\text{Antenna Factor} + \text{Cable Loss} + \text{Read Level} - \text{Preamp Factor} = \text{Level}$
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. For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration)

ABOVE 1G



The setting of the spectrum analyser

RBW	1MHz
VBW	3MHz
Sweep	Auto
Detector	Peak and CISPR Average
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 1.5 meter 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. Corrected Reading: $\text{Antenna Factor} + \text{Cable Loss} + \text{Read Level} - \text{Preamp Factor} = \text{Level}$
6. For measurement above 1GHz, the emission measurement will be measured by the peak detector and the AV detector.
7. For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration)

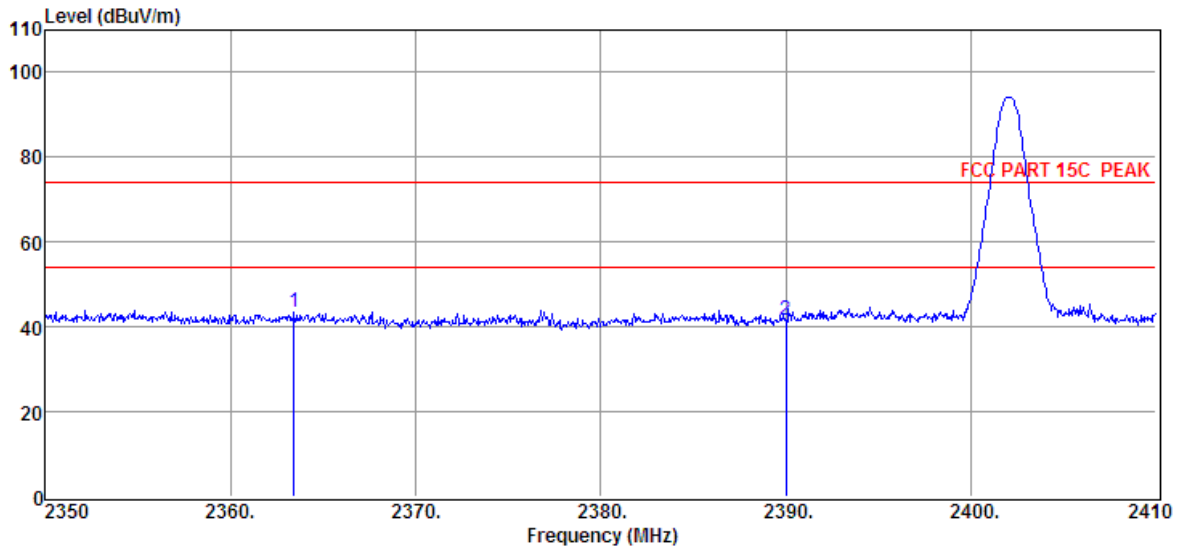
TEST CONDITIONS

Temperature: 22.2°C
 Relative Humidity: 61%
 Test Voltage: DC 12V

7.2. RESTRICTED BANDEGE

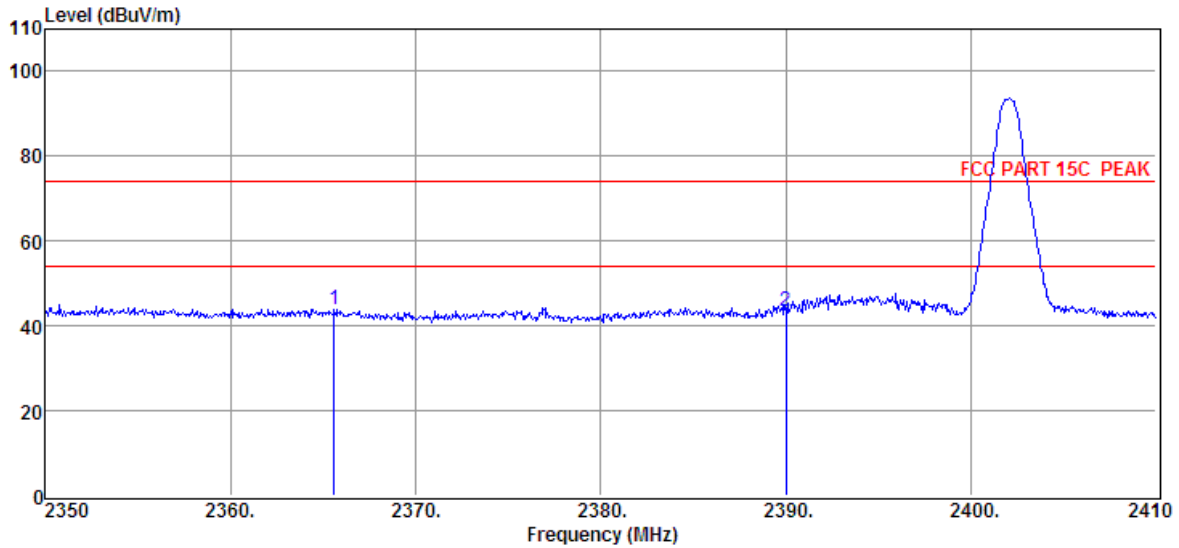
7.2.1. GFSK MODE

RESTRICTED BANDEGE (LOW CHANNEL, HORIZONTAL)



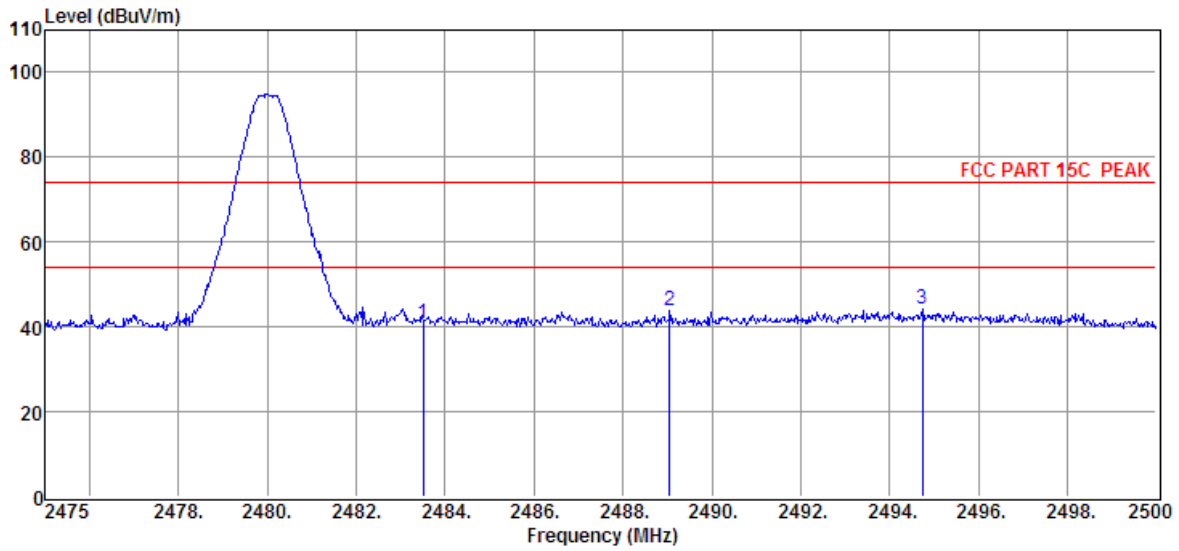
Item (Mark)	Freq. (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Facto r dB	Cable Loss dB	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detect or	Polarization
1	2363.44	37.36	29.67	29.37	5.98	43.64	74.00	-30.36	Peak	HORIZONTAL
2	2390.00	35.16	29.78	29.41	6.01	41.54	74.00	-32.46	Peak	HORIZONTAL

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



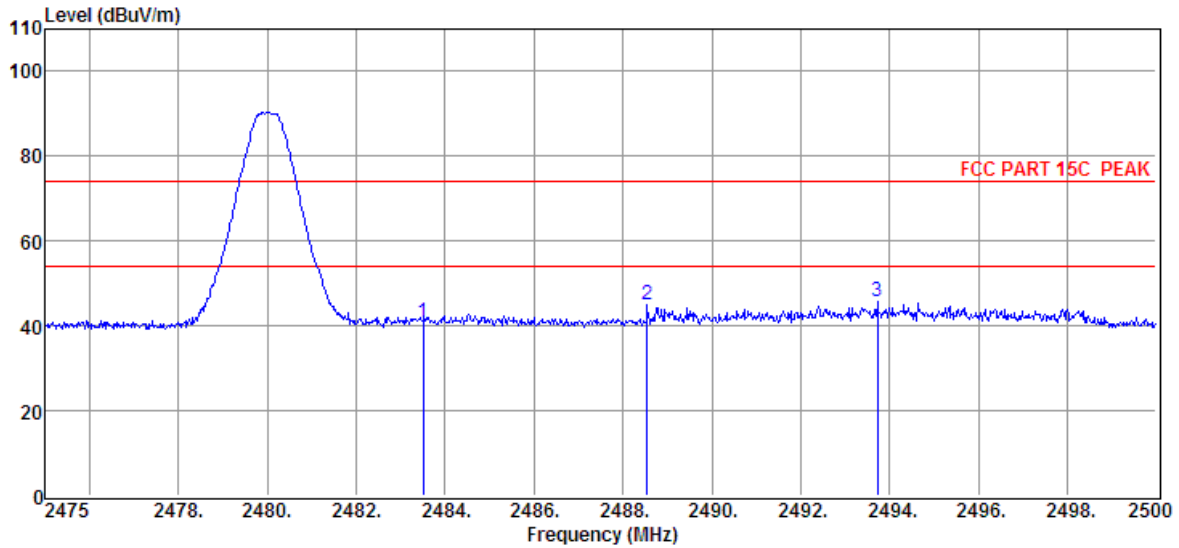
Item (Mark)	Freq. (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Factor (dB)	Cable Loss (dB)	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	2365.60	37.66	29.68	29.37	5.98	43.95	74.00	-30.05	Peak	VERTICAL
2	2390.00	36.99	29.78	29.41	6.01	43.37	74.00	-30.63	Peak	VERTICAL

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	PRM Factor dB	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	2483.50	34.39	30.14	29.71	6.15	40.97	74.00	-33.03	Peak	HORIZONTAL
2	2489.05	37.19	30.16	29.71	6.15	43.79	74.00	-30.21	Peak	HORIZONTAL
3	2494.75	37.51	30.18	29.73	6.15	44.11	74.00	-29.89	Peak	HORIZONTAL

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

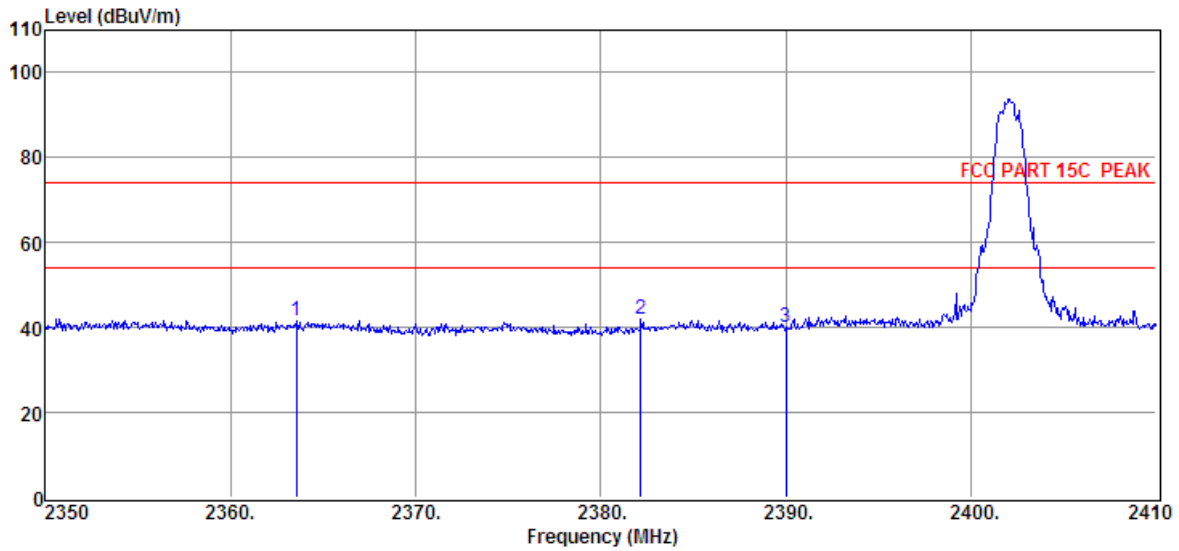


Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	PRM Facto r dB	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	2483.50	34.39	30.14	29.71	6.15	40.97	74.00	-33.03	Peak	VERTICAL
2	2488.55	38.22	30.16	29.71	6.15	44.82	74.00	-29.18	Peak	VERTICAL
3	2493.73	39.28	30.18	29.73	6.15	45.88	74.00	-28.12	Peak	VERTICAL

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

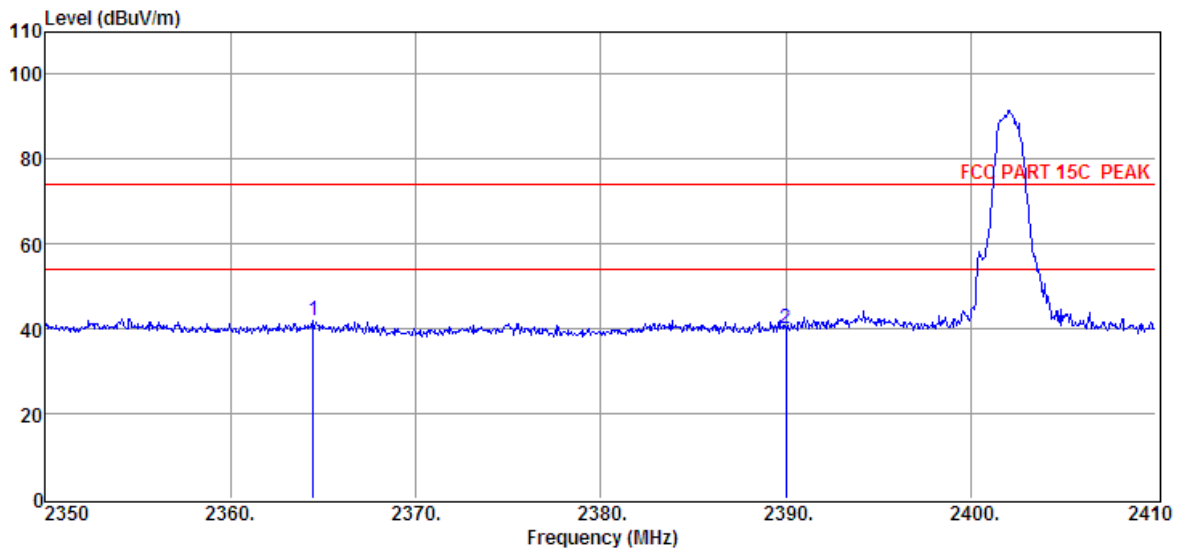
7.2.2. 8-DPSK MODE

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



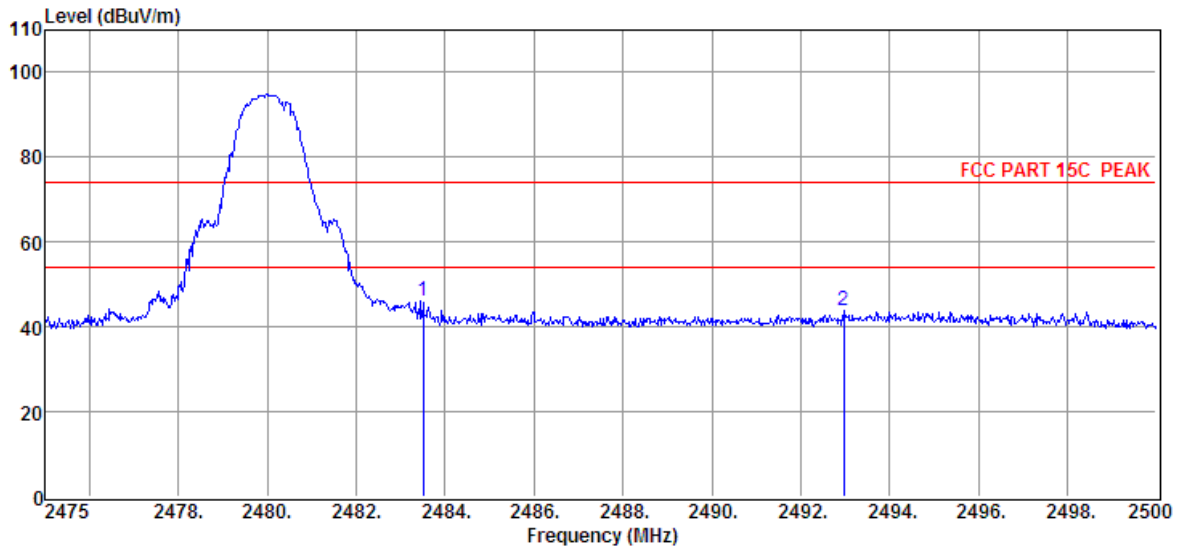
Item (Mark)	Freq. (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Facto r dB	Cable Loss dB	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	2363.56	35.39	29.67	29.37	5.98	41.67	74.00	-32.33	Peak	HORIZONTAL
2	2382.16	35.56	29.75	29.39	6.01	41.93	74.00	-32.07	Peak	HORIZONTAL
3	2390.00	33.83	29.78	29.41	6.01	40.21	74.00	-33.79	Peak	HORIZONTAL

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



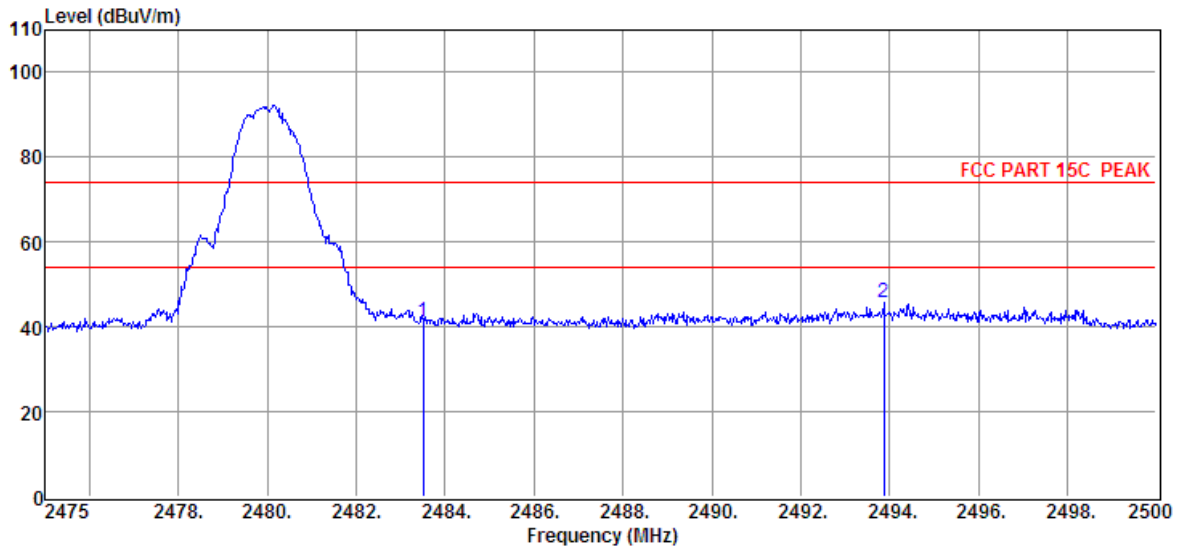
Item (Mark)	Freq. (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Facto r dB	Cable Loss dB	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	2364.46	35.77	29.68	29.37	5.98	42.06	74.00	-31.94	Peak	VERTICAL
2	2390.00	33.85	29.78	29.41	6.01	40.23	74.00	-33.77	Peak	VERTICAL

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



Item (Mark)	Freq. (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Facto r dB	Cable Loss dB	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	2483.50	39.47	30.14	29.71	6.15	46.05	74.00	-27.95	Peak	HORIZONTAL
2	2492.98	37.20	30.17	29.73	6.15	43.79	74.00	-30.21	Peak	HORIZONTAL

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



Item (Mark)	Freq. (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Facto r dB	Cable Loss dB	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	2483.50	34.45	30.14	29.71	6.15	41.03	74.00	-32.97	Peak	VERTICAL
2	2493.88	39.27	30.18	29.73	6.15	45.87	74.00	-28.13	Peak	VERTICAL

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

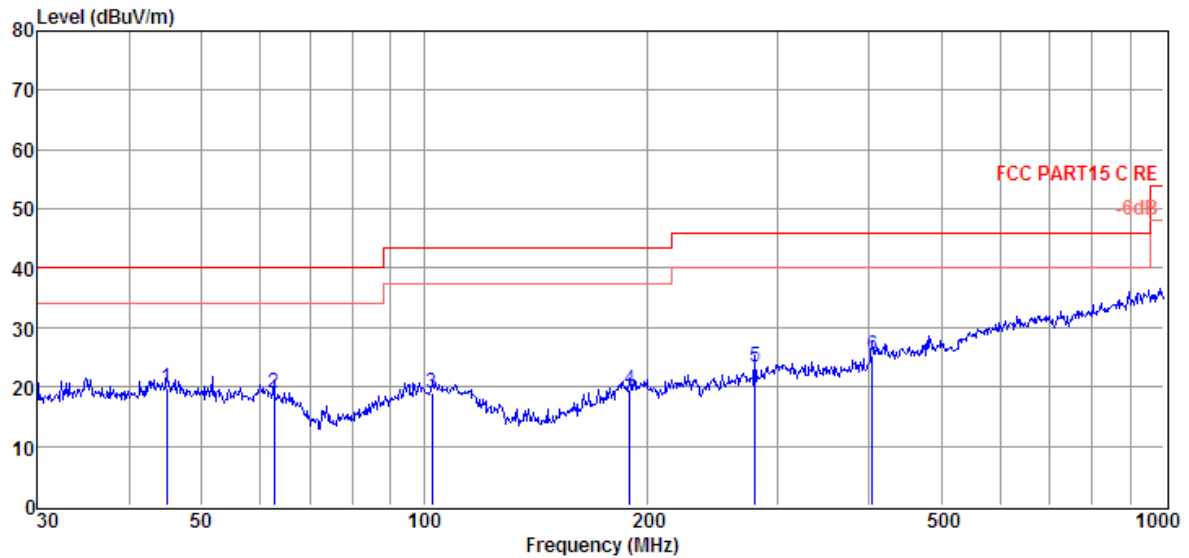
7.3. SPURIOUS EMISSIONS (1~25GHz)

HARMONICS AND SPURIOUS EMISSIONS

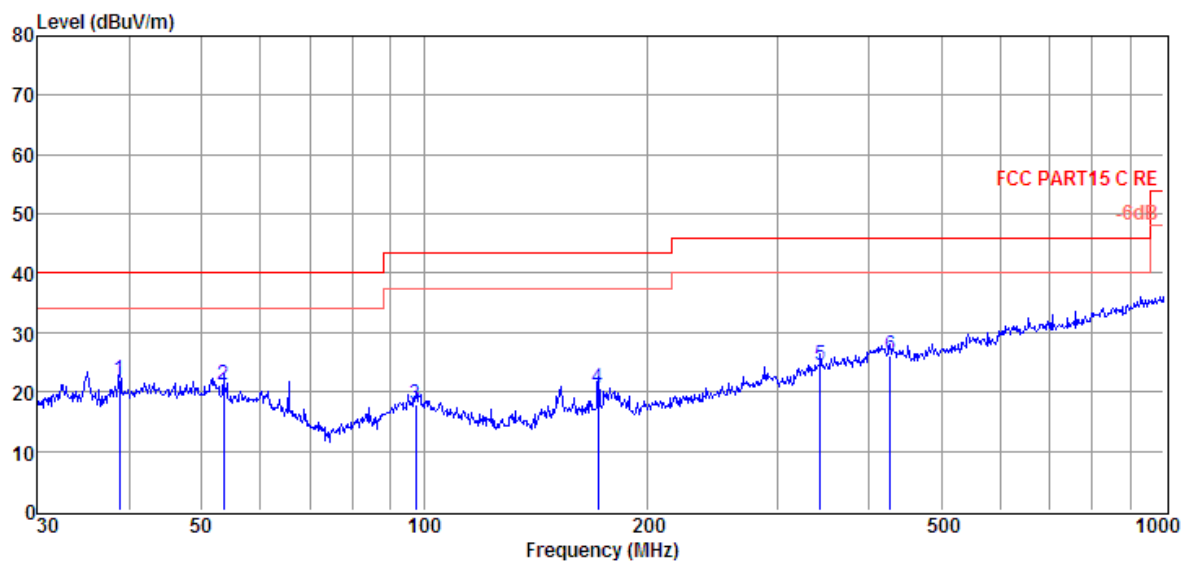
Freq (MHz)	Read level (dBμV)	Antenna Factor (dB/m)	PRM Factor (dB)	Cable Loss (dB)	Result Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector type	Polarization
GFSK Tx mode 2402MHz									
1329.00	46.91	24.73	29.37	4.49	46.76	74.00	-27.24	Peak	VERTICAL
1854.00	41.39	27.44	29.01	5.34	45.16	74.00	-28.84	Peak	VERTICAL
3464.00	35.70	31.89	29.62	7.26	45.23	74.00	-28.77	Peak	VERTICAL
4003.00	36.67	33.40	29.04	7.61	48.64	74.00	-25.36	Peak	VERTICAL
4801.00	34.92	33.74	29.32	8.46	47.80	74.00	-26.20	Peak	VERTICAL
7209.00	36.29	36.37	30.49	10.60	52.77	74.00	-21.23	Peak	VERTICAL
3331.00	35.92	31.84	29.90	7.13	44.99	74.00	-29.01	Peak	HORIZONTAL
3940.00	34.73	33.23	29.07	7.58	46.47	74.00	-27.53	Peak	HORIZONTAL
5172.00	33.35	34.05	29.33	8.85	46.92	74.00	-27.08	Peak	HORIZONTAL
6047.00	33.67	35.08	29.23	9.71	49.23	74.00	-24.77	Peak	HORIZONTAL
7209.00	33.87	36.37	30.49	10.60	50.35	74.00	-23.65	Peak	HORIZONTAL
7727.00	32.99	36.65	30.99	10.98	49.63	74.00	-24.37	Peak	HORIZONTAL
GFSK Tx mode 2441MHz									
1329.00	43.23	24.73	29.37	4.49	43.08	74.00	-30.92	Peak	VERTICAL
1861.00	41.63	27.47	29.01	5.34	45.43	74.00	-28.57	Peak	VERTICAL
3464.00	35.82	31.89	29.62	7.26	45.35	74.00	-28.65	Peak	VERTICAL
4066.00	36.05	33.46	29.05	7.69	48.15	74.00	-25.85	Peak	VERTICAL
6061.00	33.11	35.10	29.23	9.72	48.70	74.00	-25.30	Peak	VERTICAL
7328.00	36.64	36.47	30.59	10.71	53.23	74.00	-20.77	Peak	VERTICAL
1861.00	37.56	27.47	29.01	5.34	41.36	74.00	-32.64	Peak	HORIZONTAL
3394.00	36.03	31.86	29.79	7.19	45.29	74.00	-28.71	Peak	HORIZONTAL
3933.00	35.22	33.21	29.07	7.57	46.93	74.00	-27.07	Peak	HORIZONTAL
4885.00	33.34	33.72	29.33	8.56	46.29	74.00	-27.71	Peak	HORIZONTAL
6586.00	32.40	35.87	30.00	10.03	48.30	74.00	-25.70	Peak	HORIZONTAL
7580.00	32.10	36.62	30.88	10.90	48.74	74.00	-25.26	Peak	HORIZONTAL
GFSK Tx mode 2480MHz									
3464.00	35.90	31.89	29.62	7.26	45.43	74.00	-28.57	Peak	VERTICAL
3947.00	35.18	33.25	29.07	7.58	46.94	74.00	-27.06	Peak	VERTICAL
5606.00	31.57	34.77	29.24	9.29	46.39	74.00	-27.61	Peak	VERTICAL
6054.00	32.94	35.09	29.23	9.71	48.51	74.00	-25.49	Peak	VERTICAL
6796.00	32.81	36.04	30.24	10.24	48.85	74.00	-25.15	Peak	VERTICAL
7447.00	36.17	36.56	30.73	10.81	52.81	74.00	-21.19	Peak	VERTICAL
3954.00	34.35	33.27	29.06	7.58	46.14	74.00	-27.86	Peak	HORIZONTAL
4360.00	34.66	33.69	29.13	8.00	47.22	74.00	-26.78	Peak	HORIZONTAL
4962.00	35.00	33.71	29.34	8.63	48.00	74.00	-26.00	Peak	HORIZONTAL
6180.00	32.12	35.30	29.34	9.77	47.85	74.00	-26.15	Peak	HORIZONTAL
6803.00	32.66	36.05	30.24	10.24	48.71	74.00	-25.29	Peak	HORIZONTAL
7447.00	36.55	36.56	30.73	10.81	53.19	74.00	-20.81	Peak	HORIZONTAL
Result: Pass									
Note1: 1.30MHz~18GHz: (Scan with GFSK, π/4 QPSK, 8-DPSK, the worst case is GFSK Mode)									
2. Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor.									
Note2: EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.									

7.4. SPURIOUS EMISSIONS 30M ~ 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)



Item (Mark)	Freq. (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	Cable Loss (dB)	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	44.90	3.68	12.31	3.84	19.83	40.00	-20.17	QP	HORIZONTAL
2	62.65	4.58	10.51	4.00	19.09	40.00	-20.91	QP	HORIZONTAL
3	102.36	2.74	11.81	4.31	18.86	43.50	-24.64	QP	HORIZONTAL
4	189.74	4.84	9.80	4.84	19.48	43.50	-24.02	QP	HORIZONTAL
5	280.02	5.52	12.60	5.28	23.40	46.00	-22.60	QP	HORIZONTAL
6	403.25	3.83	15.77	5.81	25.41	46.00	-20.59	QP	HORIZONTAL



Item (Mark)	Freq. (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	Cable Loss (dB)	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	38.75	6.25	12.10	3.78	22.13	40.00	-17.87	QP	VERTICAL
2	53.51	5.44	11.70	3.92	21.06	40.00	-18.94	QP	VERTICAL
3	97.46	1.71	11.80	4.28	17.79	43.50	-25.71	QP	VERTICAL
4	172.00	7.30	8.60	4.73	20.63	43.50	-22.87	QP	VERTICAL
5	343.18	4.17	14.70	5.56	24.43	46.00	-21.57	QP	VERTICAL
6	426.52	3.97	16.23	5.90	26.10	46.00	-19.90	QP	VERTICAL

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

7.5. SPURIOUS EMISSIONS BELOW 30M

Note 1: The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

Note 2: EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

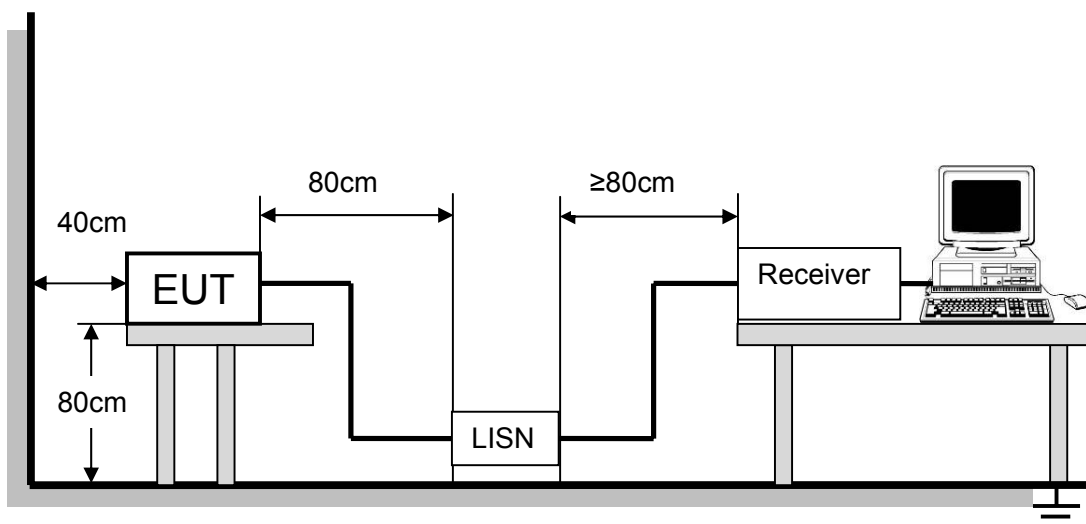
8. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

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

FREQUENCY (MHz)	Class A (dBuV)		Class B (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 -0.5	79.00	66.00	66 - 56 *	56 - 46 *
0.50 -5.0	73.00	60.00	56.00	46.00
5.0 -30.0	73.00	60.00	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 7 and 13 of ANSI C63.4-2014. 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 RESULTS

Not Applicable

9. ANTENNA REQUIREMENTS

APPLICABLE REQUIREMENTS

Please refer to FCC §15.203

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi. 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 FCC rule.

ANTENNA CONNECTOR

EUT has a PCB antenna without antenna connector.

ANTENNA GAIN

The antenna gain of EUT is less than 6 dBi.

END OF REPORT

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