SGS-CSTC Standards Technical Services Co., Ltd.
Shenzhen Branch

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FCC REPORT

Application No:	SZEM1512007846CR
Applicant:	Creative Labs Inc
Manufacturer:	Creative Technology Ltd.
Product Name:	Creative Sound Blaster ROAR PRO
Model No.(EUT):	MF8171
Trade Mark:	Creative
FCC ID:	IBAMF8170
Standards:	47 CFR Part 15, Subpart C (2015) (only for AC Power Line Conducted Emission, Conducted Peak Output Power, and Radiated Spurious emissions)
Date of Receipt:	2015-12-23
Date of Test:	2016-01-06 to 2016-01-08
Date of Issue:	2016-01-21
Test Result:	**PASS ***

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

Jack Zhang
EMC Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.
The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. All test results in this report can be traceable to National or International Standards.

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2 Version

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
00		2015-08-11		Original
01		2016-01-21		New

Authorized for issue by:				
Tested By		Benson Wang **(Benson Wang) /Project Engineer**		2016-01-08 **Date**
Prepared By		Iris Zhou **(Iris Zhou) /Clerk**		2016-01-21 **Date**
Checked By		Eric Fu **(Eric Fu) /Reviewer**		2016-01-21 **Date**

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3 Test Summary

Test Item	Test Requirement	Test method	Result
Antenna Requirement	47 CFR Part 15, Subpart C Section 15.203/15.247 (c)	ANSI C63.10 (2013)	PASS
AC Power Line Conducted Emission	47 CFR Part 15, Subpart C Section 15.207	ANSI C63.10 (2013)	PASS
Conducted Peak Output Power	47 CFR Part 15, Subpart C Section 15.247 (b)(1)	ANSI C63.10 (2013)	PASS
Radiated Spurious emissions	47 CFR Part 15, Subpart C Section 15.205/15.209	ANSI C63.10 (2013)	PASS

Remark:

Model No.: MF8171

This test report (Ref. No.: SZEM131200649707) is only valid with the original test report (Ref. No.: SZEM131200649701, SZEM131200649703 and SZEM131200649705).

Review this report and original report, the major change filed under this application is:

1.Add alternate power adapter model FJ-SW1501600N.

	Before	After
Adapter	Model:GPE024W-150160-Z INPUT: AC 100-240V 50/60Hz 0.75A OUTPUT: DC 15V 1600mA 24W	Model:GPE024W-150160-Z INPUT: AC 100-240V 50/60Hz 0.75A OUTPUT: DC 15V 1600mA 24W
		Model: FJ-SW1501600N Input: 100-240V, 50/60Hz 0.6A Max output: DC 15V,1600mA

Review SZEM131200649705 and original report, the major change filed under this application is:

1. Add Model No: MF8171, Product Name CREATIVE SOUND BLASTER ROAR PRO.
2. CREATIVE SOUND BLASTER ROAR PRO is a derivative model of CREATIVE SOUND BLASTER ROAR SR20A with changes in product features, antenna gain and adapter. No other electrical differences other than those stated below. Mechanical design and construction are identical for both models.

	BEFORE	AFTER
Model No	1. MF8170	1. MF8170

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<table>
<tr><td></td><td></td><td>2. MF8171</td></tr>
<tr><td>Product Name</td><td>SOUND BLASTER ROAR SR20,
SOUND BLASTER ROAR SR20A</td><td>SOUND BLASTER ROAR SR20 (Model No: MF8170)
SOUND BLASTER ROAR SR20A (Model No: MF8170)
SOUND BLASTER ROAR PRO (Model No: MF8171)</td></tr>
<tr><td>Antenna Gain</td><td>0.25 dBi</td><td>No change for SOUND BLASTER ROAR SR20 and SOUND BLASTER ROAR SR20A.

SOUND BLASTER ROAR PRO: 4.11 dBi</td></tr>
<tr><td>Main Board</td><td>MS2160B
REV A (0514116)</td><td>No change for SOUND BLASTER ROAR SR20 and SOUND BLASTER ROAR SR20A.

SOUND BLASTER ROAR PRO:
MS2160B Rev A (081520) & MS2165B Rev 1P (001521): Add C334 (10PF), C335 (10PF), C336 (10PF), C337 (10PF), C339 (10PF)
Change: R162 (12K to 100R), R203 (12K to 100R), R142 (22K to 15K), R143 (22K to 15K), R219 (10K to 12K), R116 (330K to 300K)
Remove: R92 (10K), R93 (10K), C72 (820PF), C77 (820PF).

<table>
<tr><td>Version</td><td>Old Volume IC</td><td>New Volume IC</td></tr>
<tr><td>Main board</td><td>MS2160B
Rev A (081520)</td><td>MS2165B
Rev 1P (001521)</td></tr>
<tr><td>Volume IC</td><td>MP61545 (U17)</td><td>NJU72431 (U4)</td></tr>
<tr><td>R214</td><td>Not Mounted</td><td>4K7</td></tr>
<tr><td>C313</td><td>Not Mounted</td><td>10UF</td></tr>
<tr><td>R324</td><td>Not Mounted</td><td>10K</td></tr>
</table>
</td></tr>
<tr><td>Mp3 Key Board</td><td>SOUND BLASTER ROAR SR20:
MS2160E, REV A (031404)

SOUND BLASTER ROAR SR20A:</td><td>No change for SOUND BLASTER ROAR SR20 and SOUND BLASTER ROAR SR20A.

SOUND BLASTER ROAR PRO: MS2165E, REV A</td></tr>
</table>

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	MS2160E, REV A (041422)	(011520).
Product Feature	SOUND BLASTER ROAR SR20: Loud Sounds SOUND BLASTER ROAR SR20A: Remove Loud Sounds. Add Link Security and Tera Bass.	No change for SOUND BLASTER ROAR SR20 and SOUND BLASTER ROAR SR20A. SOUND BLASTER ROAR PRO: Remove Link Security. Add EQ – Warm / Neutral / Energetic.

Considering to the difference, pre-scan were performed on the sample in this report to find the items which can be influential to the result in the original test report for fully retest.

Therefore in this report **AC Power Line Conducted Emission, Conducted Peak Output Power,** and **Radiated Spurious emissions** were fully retested on model MF8171 and shown the data in this report, other tests please refer to original report SZEM131200649701.

Additionally, just updated the below standard.

Original report standard	The newest report standard
47 CFR Part 15, Subpart C (2013)	47 CFR Part 15, Subpart C (2015)

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5 General Information

5.1 Client Information

Applicant:	Creative Labs Inc
Address of Applicant:	1901 McCarthy Blvd, Milpitas, California, United States
Manufacturer:	Creative Technology Ltd.
Address of Manufacturer:	31, International Business Park, #03-01 Creative Resource, Singapore 609921

5.2 General Description of EUT

Product Name:	Creative Sound Blaster ROAR PRO
Model No.:	MF8171
Trade Mark:	Creative
Operation Frequency:	2402MHz~2480MHz
Bluetooth Version:	V3.0
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)
Modulation Type:	GFSK, π/4DQPSK, 8DPSK
Number of Channel:	79
Hopping Channel Type:	Adaptive Frequency Hopping systems
Sample Type:	Portable production
Test Power Grade:	255, 46 (manufacturer declare)
Test Software of EUT:	Blue Test 3
Antenna Type:	Integral
Antenna Gain:	4.11dBi
Battery:	7.56V Li-ion Battery 2950mAh 22.3Wh Model No.: BJ-ACEXX-3KXKUX-01
Cable length/material:	Usb cable:76cm shielded Dc cable: 175cm unshielded
Adapter	Adapter in original report (SZEM131200649701): Model: GPE024W-150160-Z Input: 100-240V~50/60Hz 0.75A Output: 15V ⎓ 1600mA 24W Adapter in this report (SZEM131200649707): Model: FJ-SW1501600N Input: 100-240V, 50/60Hz 0.6A Max output: DC 15V,1600mA
Test Voltage	AC 120V 60Hz

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Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2402MHz	21	2422MHz	41	2442MHz	61	2462MHz
2	2403MHz	22	2423MHz	42	2443MHz	62	2463MHz
3	2404MHz	23	2424MHz	43	2444MHz	63	2464MHz
4	2405MHz	24	2425MHz	44	2445MHz	64	2465MHz
5	2406MHz	25	2426MHz	45	2446MHz	65	2466MHz
6	2407MHz	26	2427MHz	46	2447MHz	66	2467MHz
7	2408MHz	27	2428MHz	47	2448MHz	67	2468MHz
8	2409MHz	28	2429MHz	48	2449MHz	68	2469MHz
9	2410MHz	29	2430MHz	49	2450MHz	69	2470MHz
10	2411MHz	30	2431MHz	50	2451MHz	70	2471MHz
11	2412MHz	31	2432MHz	51	2452MHz	71	2472MHz
12	2413MHz	32	2433MHz	52	2453MHz	72	2473MHz
13	2414MHz	33	2434MHz	53	2454MHz	73	2474MHz
14	2415MHz	34	2435MHz	54	2455MHz	74	2475MHz
15	2416MHz	35	2436MHz	55	2456MHz	75	2476MHz
16	2417MHz	36	2437MHz	56	2457MHz	76	2477MHz
17	2418MHz	37	2438MHz	57	2458MHz	77	2478MHz
18	2419MHz	38	2439MHz	58	2459MHz	78	2479MHz
19	2420MHz	39	2440MHz	59	2460MHz	79	2480MHz
20	2421MHz	40	2441MHz	60	2461MHz		

Note:
In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The Lowest channel	2402MHz
The Middle channel	2441MHz
The Highest channel	2480MHz

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5.3 Test Environment

Operating Environment:	
Temperature:	25.0 °C
Humidity:	51 % RH
Atmospheric Pressure:	1010 mbar

5.4 Description of Support Units

The EUT has been tested with associated equipment below:

Description	Manufacturer	Model No.
Laptop(provided by SGS)	Lenovo	T430u

5.5 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch E&E Lab,
No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057.
Tel: +86 755 2601 2053 Fax: +86 755 2671 0594
No tests were sub-contracted.

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5.6 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

• **CNAS (No. CNAS L2929)**

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

• **A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• **VCCI**

The 10m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-823, R-4188, T-1153 and C-2383 respectively.

• **FCC – Registration No.: 556682**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen 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 No.: 556682.

• **Industry Canada (IC)**

The 3m Semi-anechoic chambers and the 10m Semi-anechoic chambers of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-2, 4620C-3.

5.7 Deviation from Standards

None.

5.8 Abnormalities from Standard Conditions

None.

5.9 Other Information Requested by the Customer

None.

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5.10 Equipment List

Conducted Emission						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. date (yyyy-mm-dd)**	**Cal.Due date (yyyy-mm-dd)**
1	Shielding Room	ZhongYu Electron	GB-88	SEL0042	2015-05-13	2016-05-13
2	LISN	Rohde & Schwarz	ENV216	SEL0152	2015-10-09	2016-10-09
3	LISN	ETS-LINDGREN	3816/2	SEL0021	2015-05-13	2016-05-13
4	8 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN-T8-02	SEL0162	2015-08-30	2016-08-30
5	4 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN-T4-02	SEL0163	2015-08-30	2016-08-30
6	2 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN-T2-02	SEL0164	2015-08-30	2016-08-30
7	EMI Test Receiver	Rohde & Schwarz	ESCI	SEL0022	2015-05-13	2016-05-13
8	Coaxial Cable	SGS	N/A	SEL0025	2015-05-13	2016-05-13
9	DC Power Supply	Zhao Xin	RXN-305D	SEL0117	2015-10-09	2016-10-09
10	Humidity/ Temperature Indicator	Shanhai Qixiang	ZJ1-2B	SEL0103	2015-10-24	2016-10-24
11	Barometer	Chang Chun	DYM3	SEL0088	2015-05-13	2016-05-13

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RE in Chamber						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. date (yyyy-mm-dd)**	**Cal.Due date (yyyy-mm-dd)**
1	3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEL0017	2015-05-13	2016-05-13
2	EMI Test Receiver	Agilent Technologies	N9038A	SEL0312	2015-09-16	2016-09-16
3	EMI Test software	AUDIX	E3	SEL0050	N/A	N/A
4	BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEL0015	2014-11-15	2017-11-15
5	Double-ridged horn (1-18GHz)	ETS-LINDGREN	3117	SEL0006	2015-10-17	2016-10-17
6	Horn Antenna (18-26GHz)	ETS-LINDGREN	3160	SEL0076	2014-11-24	2017-11-24
7	Pre-amplifier (0.1-1300MHz)	Agilent Technologies	8447D	SEL0053	2015-05-13	2016-05-13
8	Pre-Amplifier (0.1-26.5GHz)	Compliance Directions Systems Inc.	PAP-0126	SEL0168	2015-10-17	2016-10-17
9	Coaxial cable	SGS	N/A	SEL0027	2015-05-13	2016-05-13
10	Coaxial cable	SGS	N/A	SEL0189	2015-05-13	2016-05-13
11	Coaxial cable	SGS	N/A	SEL0121	2015-05-13	2016-05-13
12	Coaxial cable	SGS	N/A	SEL0178	2015-05-13	2016-05-13
13	Band filter	Amindeon	82346	SEL0094	2015-05-13	2016-05-13
14	Barometer	Chang Chun	DYM3	SEL0088	2015-05-13	2016-05-13
15	DC Power Supply	Zhao Xin	RXN-305D	SEL0117	2015-10-09	2016-10-09
16	Humidity/ Temperature Indicator	Shanhai Qixiang	ZJ1-2B	SEL0103	2015-10-24	2016-10-24
17	Signal Generator (10M-27GHz)	Rohde & Schwarz	SMR27	SEL0067	2015-05-13	2016-05-13
18	Loop Antenna	Beijing Daze	ZN30401	SEL0203	2015-05-13	2016-05-13

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RF connected test						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal. date (yyyy-mm-dd)**	**Cal.Due date (yyyy-mm-dd)**
1	DC Power Supply	Zhao Xin	RXN-305D	SEL0117	2015-10-09	2016-10-09
2	Humidity/ Temperature Indicator	HYGRO	ZJ1-2B	SEL0033	2015-10-24	2016-10-24
3	Spectrum Analyzer	Rohde & Schwarz	FSP	SEL0154	2015-10-17	2016-10-17
4	Coaxial cable	SGS	N/A	SEL0178	2015-05-13	2016-05-13
5	Coaxial cable	SGS	N/A	SEL0179	2015-05-13	2016-05-13
6	Barometer	ChangChun	DYM3	SEL0088	2015-05-13	2016-05-13
7	Signal Generator	Rohde & Schwarz	SML03	SEL0068	2015-04-25	2016-04-25
8	POWER METER	R & S	NRVS	SEL0144	2015-10-09	2016-10-09
9	Attenuator	Beijin feihang taida	TST-2-6dB	SEL0205	2015-04-25	2016-04-25

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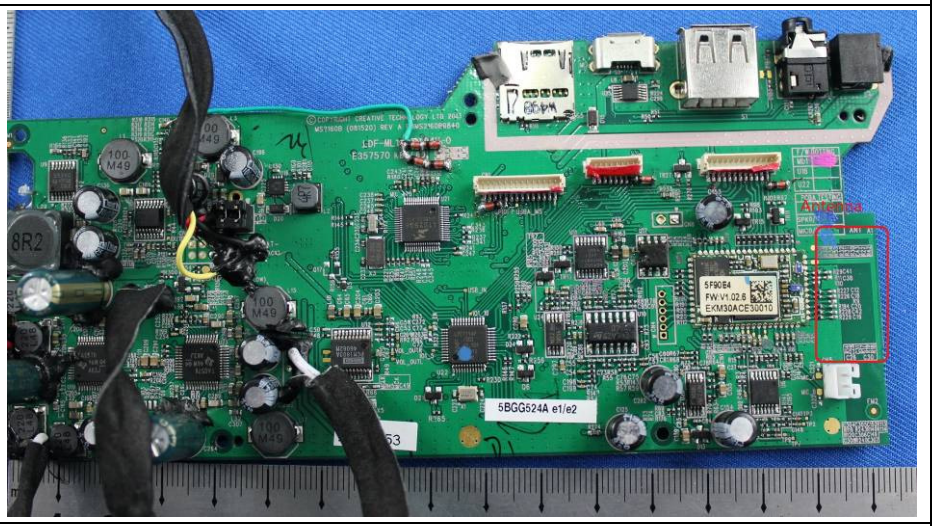
6 Test results and Measurement Data

6.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C Section 15.203 /247(c)
15.203 requirement: 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, 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. 15.247(b) (4) requirement: 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.	
EUT Antenna:	
The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 4.11dBi.	

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6.2 Conducted Emissions

<table>
<tr><td>Test Requirement:</td><td>47 CFR Part 15C Section 15.207</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10: 2013</td></tr>
<tr><td>Test Frequency Range:</td><td>150kHz to 30MHz</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><td rowspan="2">Frequency range (MHz)</td><td colspan="2">Limit (dBuV)</td></tr>
<tr><td>Quasi-peak</td><td>Average</td></tr>
<tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr>
<tr><td>0.5-5</td><td>56</td><td>46</td></tr>
<tr><td>5-30</td><td>60</td><td>50</td></tr>
</table>
* Decreases with the logarithm of the frequency.
</td></tr>
<tr><td>Test Procedure:</td><td>
1) The mains terminal disturbance voltage test was conducted in a shielded room.
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane.
4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.
</td></tr>
</table>

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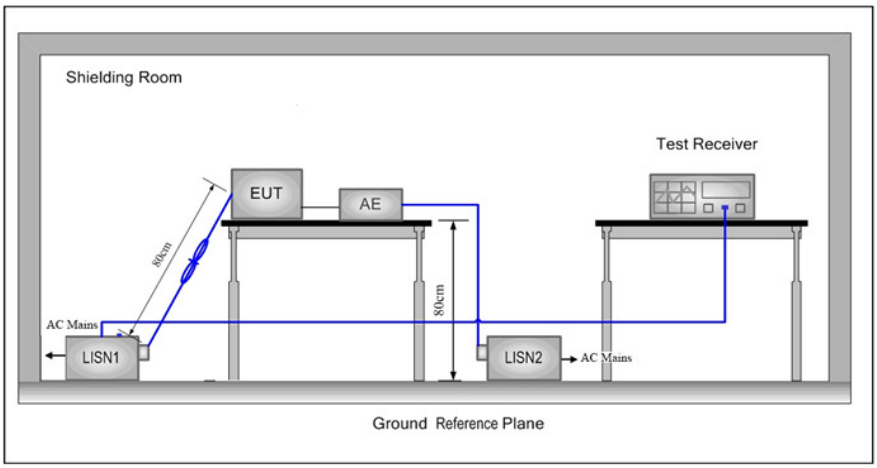
Test Setup:	
Exploratory Test Mode:	Non-hopping transmitting mode with all kind of modulation and all kind of data type at the lowest, middle, high channel. AC charge + Transmitting mode.
Final Test Mode:	Through Pre-scan, find the DH1 of data type and GFSK modulation at the lowest channel is the worst case. AC charge + Transmitting mode Only the worst case is recorded in the report.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

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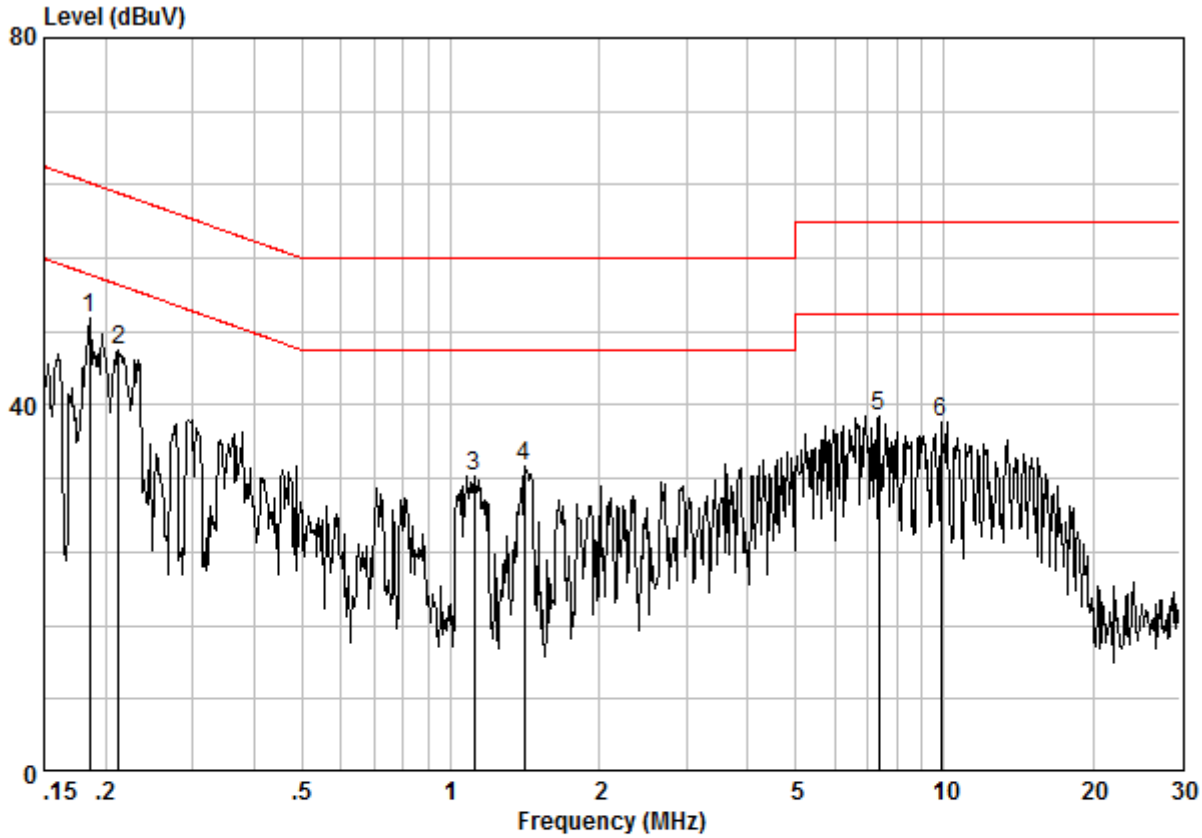
Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

Live line:



Site : Shielding Room
Condition : CE LINE
Job No. : 7846CR
Test Mode : TX+charge

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1 @	0.18541	0.02	9.60	39.87	49.49	54.24	-4.75	Peak
2 @	0.21279	0.02	9.60	36.38	46.00	53.10	-7.10	Peak
3 @	1.117	0.02	9.62	22.71	32.35	46.00	-13.65	Peak
4 @	1.411	0.02	9.59	23.77	33.38	46.00	-12.62	Peak
5 @	7.368	0.01	9.68	29.19	38.88	50.00	-11.12	Peak
6 @	9.861	0.01	9.71	28.53	38.25	50.00	-11.75	Peak

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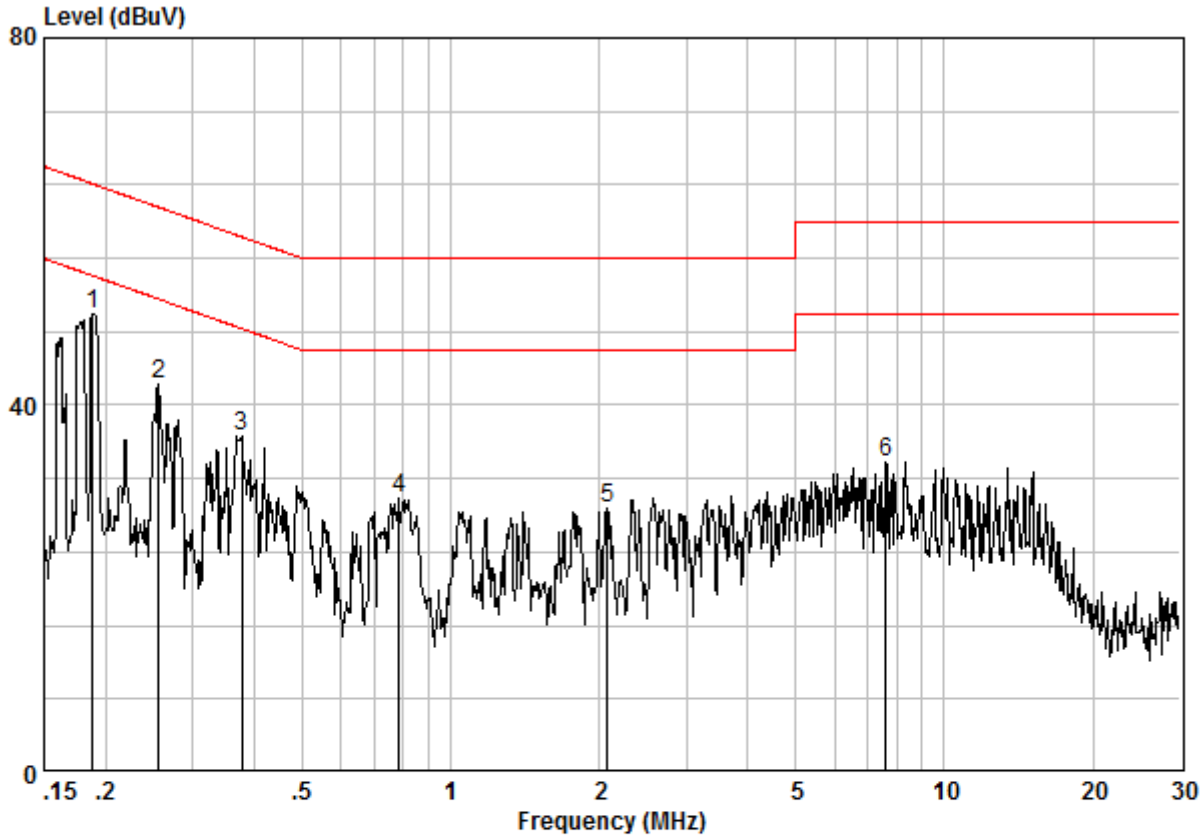
Neutral line:



Site : Shielding Room
Condition : CE NEUTRAL
Job No. : 7846CR
Test Mode : TX+charge

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1 @	0.18838	0.02	9.61	40.27	49.90	54.11	-4.21	Peak
2 @	0.25615	0.02	9.61	32.58	42.20	51.56	-9.35	Peak
3 @	0.37711	0.01	9.62	27.10	36.73	48.34	-11.62	Peak
4 @	0.78761	0.02	9.64	20.14	29.80	46.00	-16.20	Peak
5	2.077	0.02	9.66	19.19	28.87	46.00	-17.13	Peak
6 @	7.606	0.01	9.75	23.97	33.73	50.00	-16.27	Peak

Notes:

1. The following Quasi-Peak and Average measurements were performed on the EUT:

2. Final Test Level =Receiver Reading + LISN Factor + Cable Loss.

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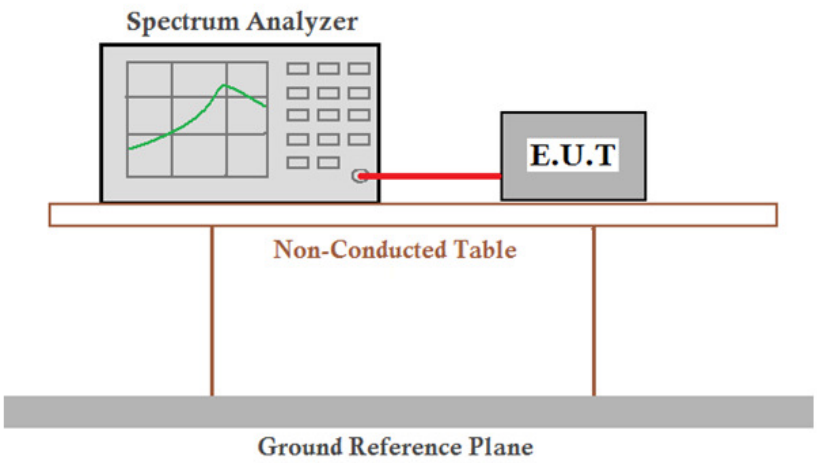
6.3 Conducted Peak Output Power

Test Requirement:	47 CFR Part 15C Section 15.247 (b)(1)
Test Method:	ANSI C63.10:2009
Test Setup:	 *Remark:* *Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer.*
Limit:	20.97dBm
Exploratory Test Mode:	Non-hopping transmitting with all kind of modulation and all kind of data type.
Final Test Mode:	Through Pre-scan, find the DH1 of data type is the worst case of GFSK modulation type, 2-DH1 of data type is the worst case of π/4DQPSK modulation type, 3-DH1 of data type is the worst case of 8DPSK modulation type.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

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Measurement Data

GFSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	-1.32	20.97	Pass
Middle	-1.15	20.97	Pass
Highest	-1.40	20.97	Pass
π/4DQPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	-0.85	20.97	Pass
Middle	-0.88	20.97	Pass
Highest	-1.34	20.97	Pass
8DPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	-0.75	20.97	Pass
Middle	-0.61	20.97	Pass
Highest	-1.34	20.97	Pass

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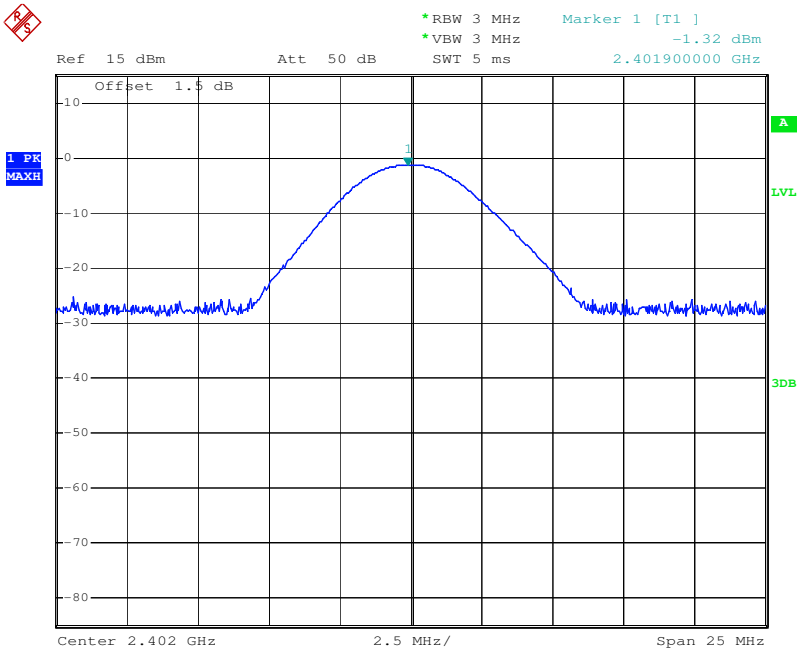
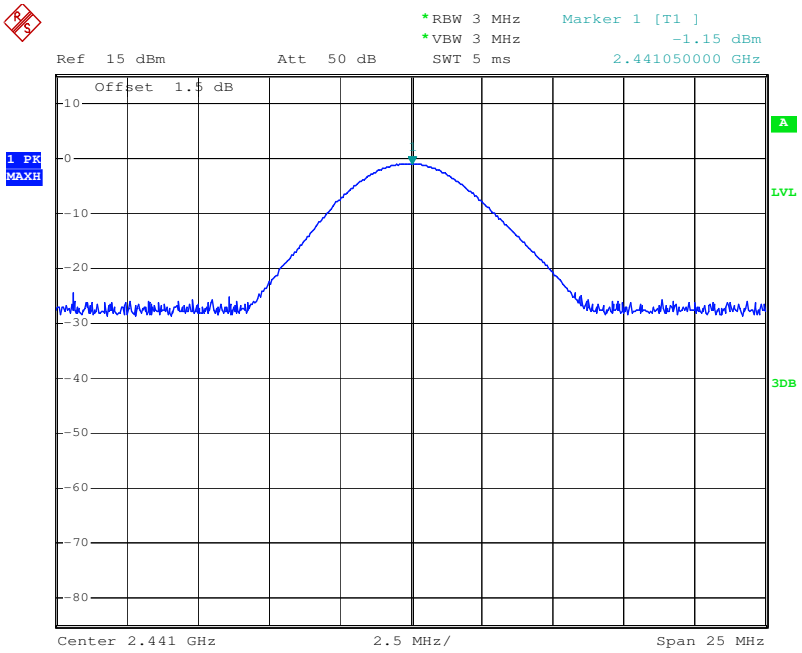
Test plot as follows:

Test mode:	GFSK	Test channel:	Lowest



Test mode:	GFSK	Test channel:	Middle



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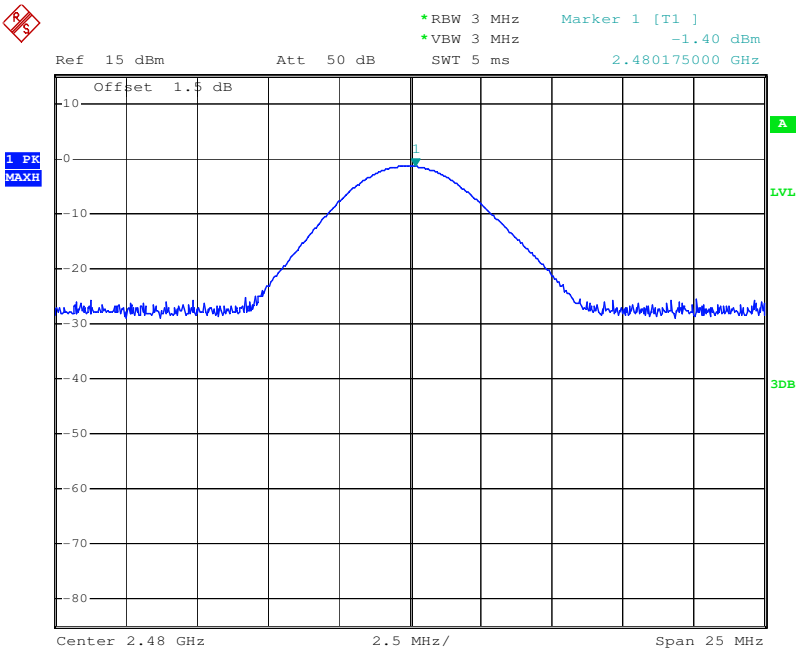
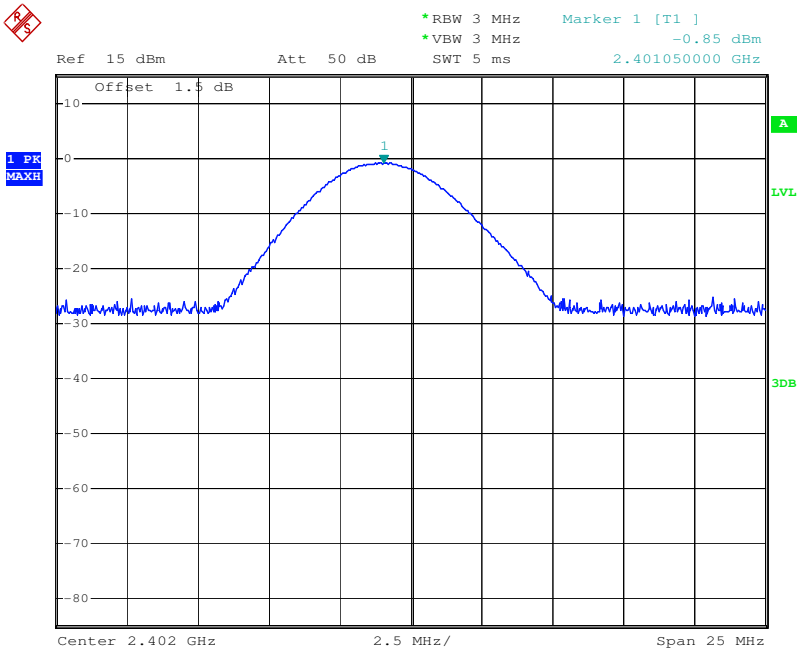
Test mode:	GFSK	Test channel:	Highest



Test mode:	π/4DQPSK	Test channel:	Lowest



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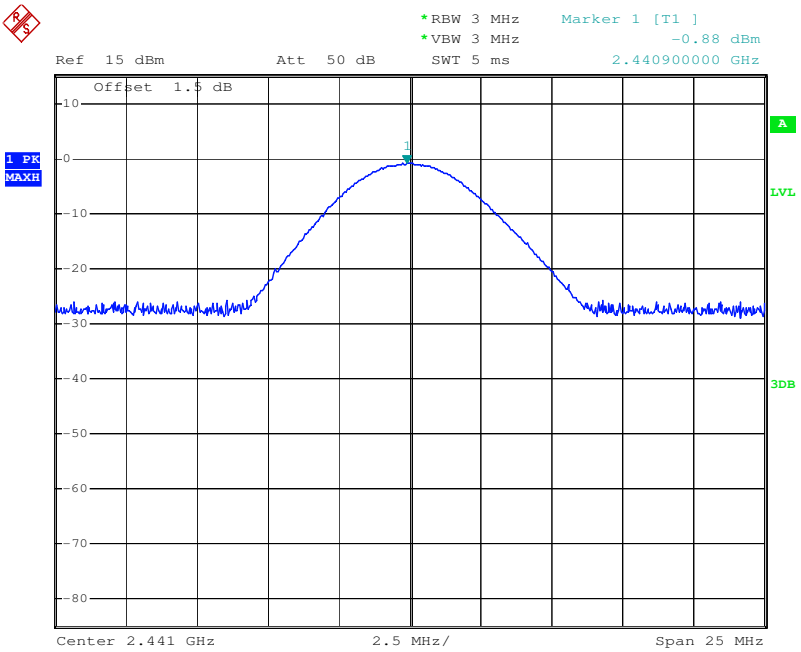
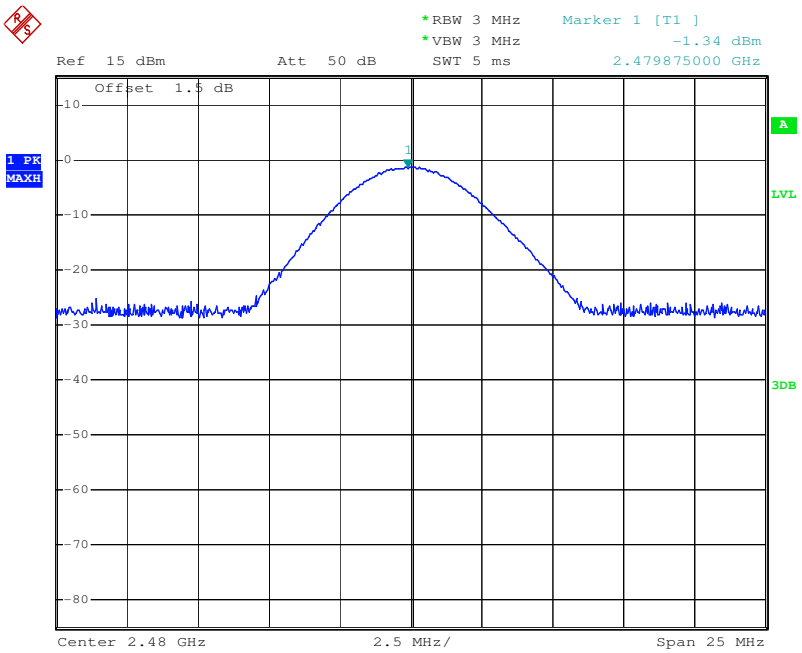
Test mode:	π/4DQPSK	Test channel:	Middle



Test mode:	π/4DQPSK	Test channel:	Highest



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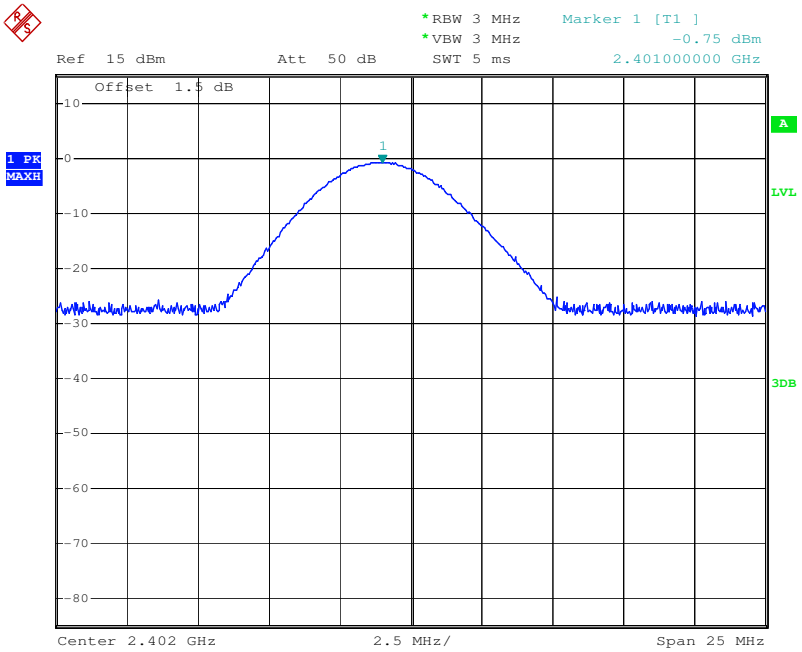
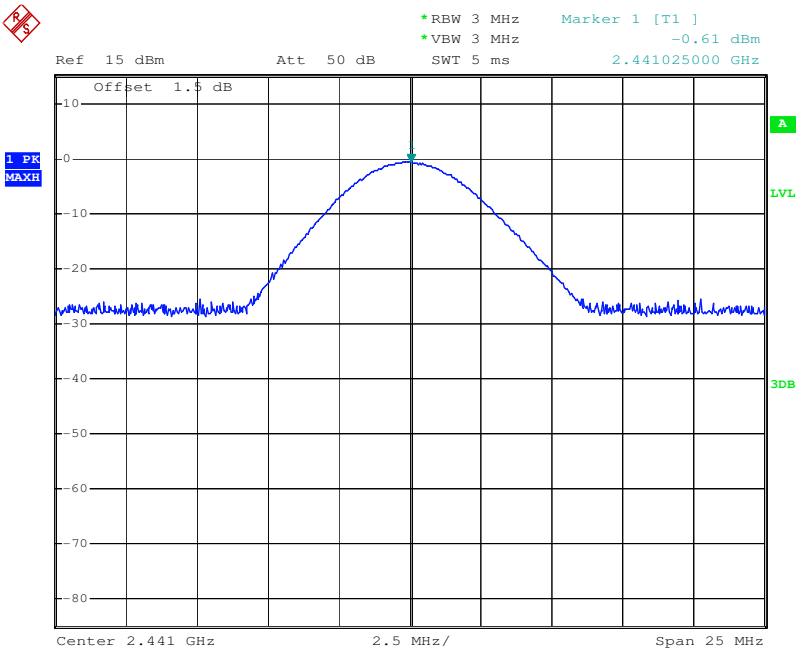
Test mode:	8DPSK	Test channel:	Lowest



Test mode:	8DPSK	Test channel:	Middle



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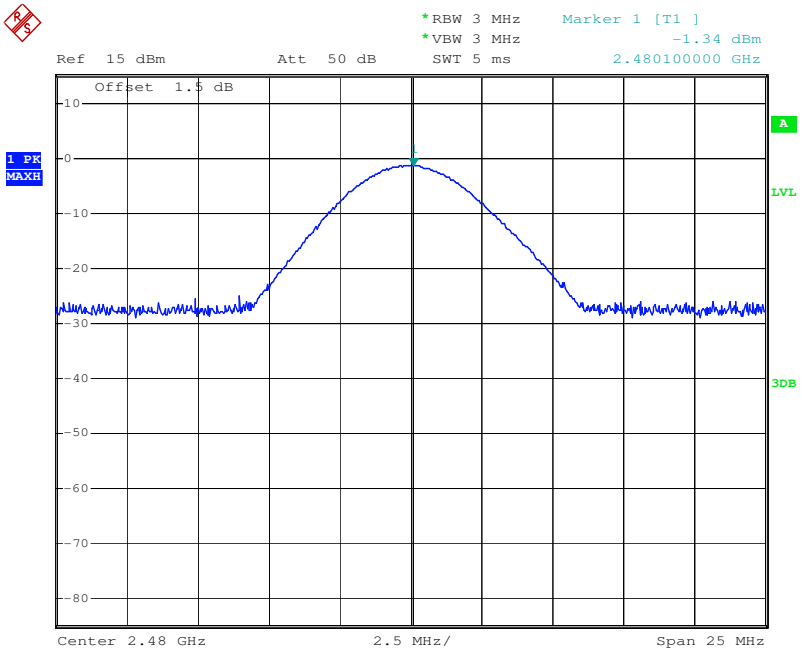
Test mode:	8DPSK	Test channel:	Highest



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6.4 Pseudorandom Frequency Hopping Sequence

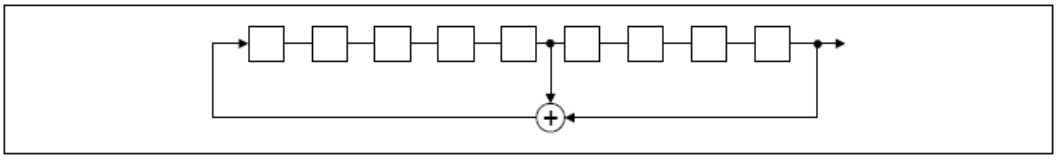
Test Requirement:	RSS247 5.1(2) requirement:

FHSs 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, FHSs operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two thirds of the -20 dB bandwidth of the hopping channel, whichever is greater, provided that the systems operate with an output power no greater than 0.125 W. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

EUT Pseudorandom Frequency Hopping Sequence

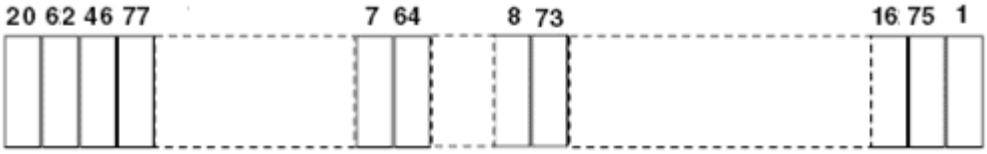
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

• Number of shift register stages: 9
• Length of pseudo-random sequence: 2^9 -1 = 511 bits
• Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter.

According to Bluetooth Core Specification, Bluetooth receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any Bluetooth transmitters and shift frequencies in synchronization with the transmitted signals.

According to Bluetooth Core Specification, the Bluetooth system transmits the packet with the pseudorandom hopping frequency with a continuous data and the short burst transmission from the Bluetooth system is also transmitted under the frequency hopping system with the pseudorandom hopping frequency system.

According to Bluetooth Core specification, the Bluetooth system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels.

According to the Bluetooth Core specification, the Bluetooth system is designed not have the ability to coordinated with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter.

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6.5 Radiated Spurious Emission

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205
Test Method:	ANSI C63.10: 2013
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)

Receiver Setup:

Frequency	Detector	RBW	VBW	Remark
0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
30MHz-1GHz	Quasi-peak	100 kHz	300kHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

Limit:

Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
1.705MHz-30MHz	30	-	-	30
30MHz-88MHz	31.6	30.0	Quasi-peak	10
88MHz-216MHz	47.3	33.5	Quasi-peak	10
216MHz-960MHz	63.1	36.0	Quasi-peak	10
960MHz-1GHz	158	44.0	Quasi-peak	10
Above 1GHz	500	54.0	Average	3

Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

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Test Setup:	

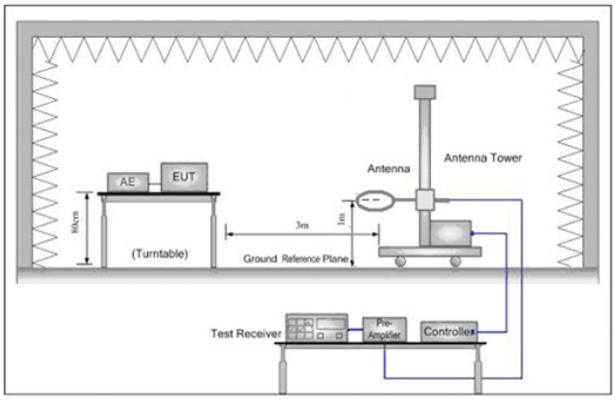

Figure 1. Below 30MHz

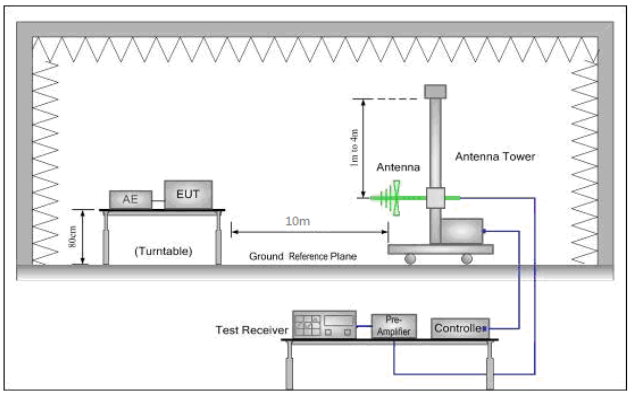

Figure 2. 30MHz to 1GHz

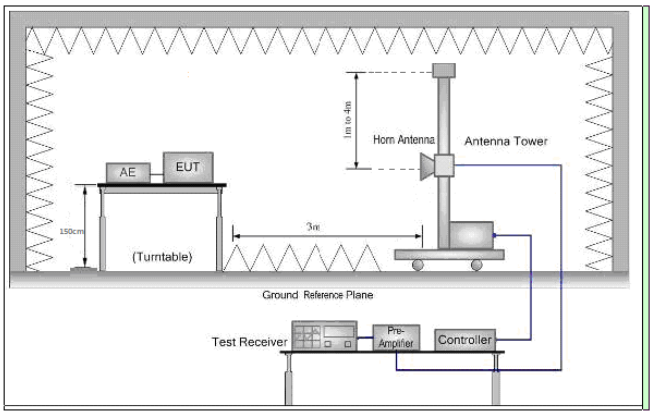

Figure 3. Above 1 GHz

Test Procedure:	a. For below 1GHz test, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation. b. For above 1GHz test, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation. c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to height 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. f. The test-receiver system was set to Peak Detect Function and Specified

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	Bandwidth with Maximum Hold Mode. g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. h. Test the EUT in the lowest channel (2402MHz),the middle channel (2441MHz),the Highest channel (2480MHz) i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case. j. Repeat above procedures until all frequencies measured was complete.
Exploratory Test Mode:	Non-hopping transmitting mode with all kind of modulation and all kind of data type. Transmitting mode, AC Charge +Transmitting mode.
Final Test Mode:	Through Pre-scan, find the DH1 of data type and GFSK modulation is the worst case. Pretest the EUT at Transmitting mode and AC Charge +Transmitting mode, found the AC Charge +Transmitting mode which it is worse case. For below 1GHz part, through pre-scan, the worst case is the lowest channel. Only the worst case is recorded in the report.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

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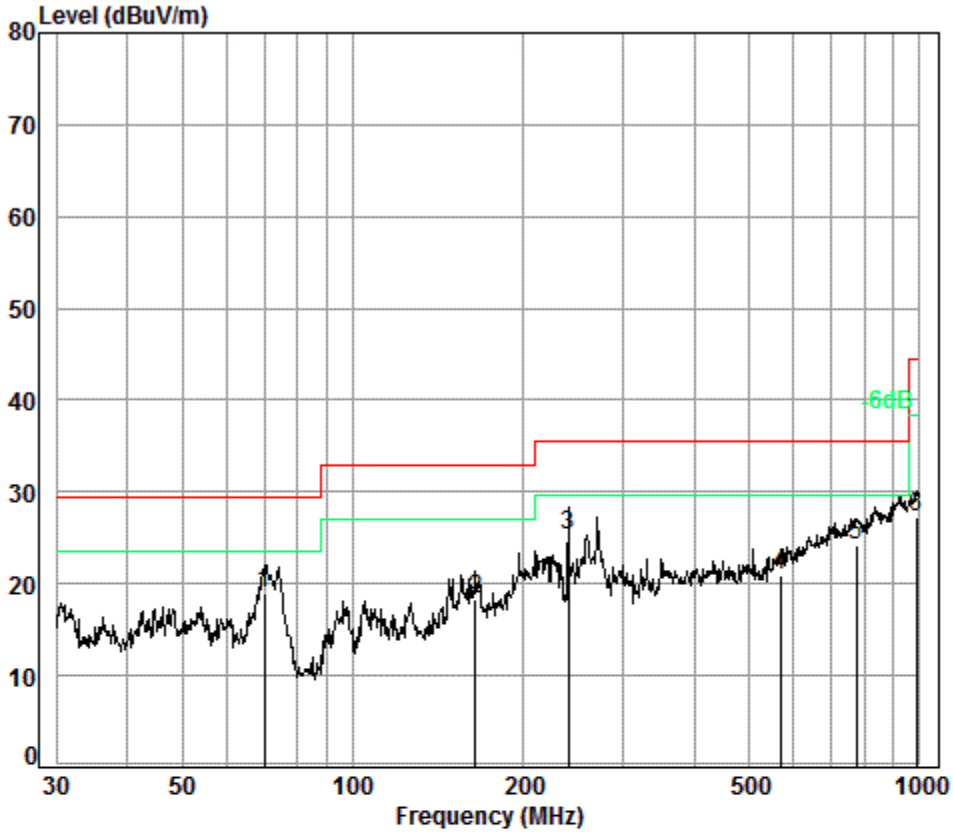
6.5.1 Radiated Emission below 1GHz

30MHz~1GHz (QP)		
Test mode:	AC Charge +Transmitting	Vertical



Condition: 10m Vertical
Job No. : 7846CR
Test Mode: TX+charge

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	69.84	6.90	10.30	32.64	34.43	18.99	29.50	-10.51
2	164.33	7.50	12.91	32.61	30.49	18.29	33.00	-14.71
3 pp	239.99	7.80	11.35	32.57	38.66	25.24	35.60	-10.36
4	568.61	8.82	18.73	32.62	25.93	20.86	35.60	-14.74
5	774.16	9.24	21.93	32.42	25.37	24.12	35.60	-11.48
6	986.07	9.60	24.04	31.02	24.55	27.17	44.40	-17.23

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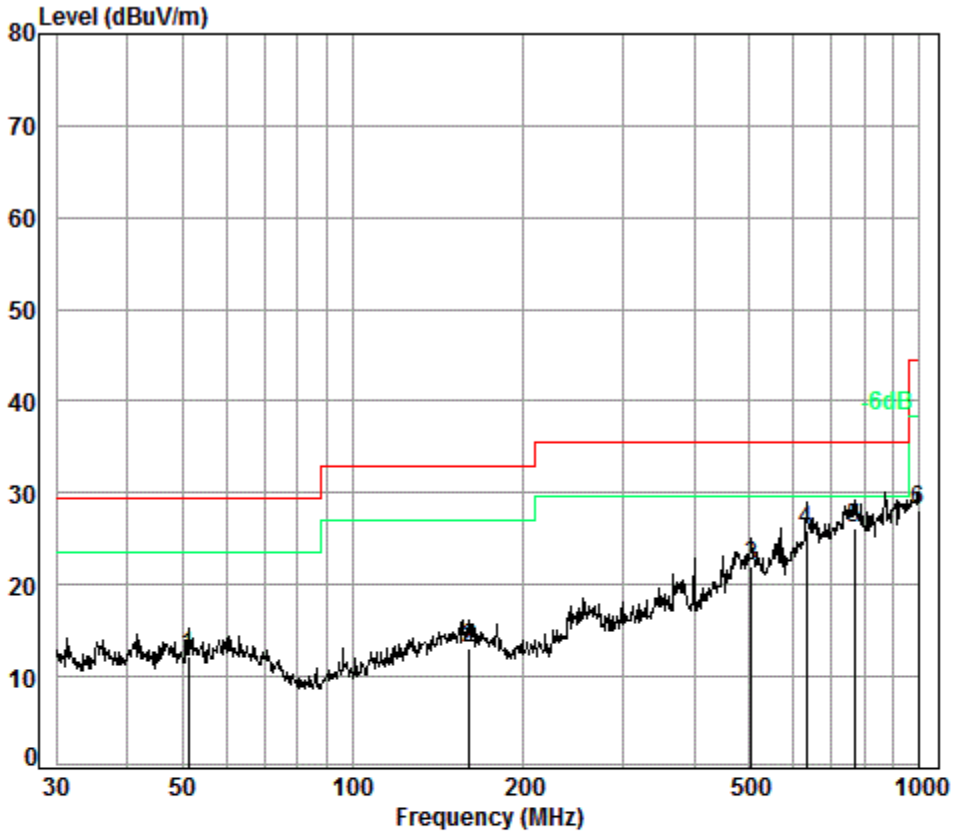
Test mode:	AC Charge +Transmitting	Horizontal



Condition: 10m Horizontal
Job No. : 7846CR
Test Mode: TX+charge

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	51.30	6.93	11.79	32.66	26.16	12.22	29.50	-17.28
2	160.91	7.50	13.10	32.61	25.15	13.14	33.00	-19.86
3	504.71	8.63	17.41	32.59	28.58	22.03	35.60	-13.57
4	631.69	8.98	19.75	32.62	29.85	25.96	35.60	-9.64
5 pp	768.75	9.22	21.91	32.44	27.55	26.24	35.60	-9.36
6	996.50	9.60	24.06	30.92	25.40	28.14	44.40	-16.26

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6.5.2 Transmitter Emission above 1GHz

Worse case mode:	GFSK(DH1)	Test channel:	Lowest	Remark:	Peak

Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
3770.567	32.78	7.73	38.47	45.25	47.29	74	-26.71	Vertical
4804.000	34.10	8.87	38.75	46.06	50.28	74	-23.72	Vertical
6016.949	34.71	10.54	38.94	45.75	52.06	74	-21.94	Vertical
7206.000	35.60	10.68	37.64	42.24	50.88	74	-23.12	Vertical
9608.000	37.10	12.50	36.35	35.65	48.90	74	-25.10	Vertical
12603.270	37.90	14.44	37.75	38.19	52.78	74	-21.22	Vertical
3803.444	32.90	7.74	38.49	44.76	46.91	74	-27.09	Horizontal
4804.000	34.10	8.87	38.75	45.37	49.59	74	-24.41	Horizontal
6016.949	34.71	10.54	38.94	46.01	52.32	74	-21.68	Horizontal
7206.000	35.60	10.68	37.64	40.93	49.57	74	-24.43	Horizontal
9608.000	37.10	12.50	36.35	35.94	49.19	74	-24.81	Horizontal
12566.850	37.87	14.34	37.72	39.26	53.75	74	-20.25	Horizontal

Worse case mode:	GFSK(DH1)	Test channel:	Middle	Remark:	Peak

Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
3792.453	32.87	7.74	38.48	45.46	47.59	74	-26.41	Vertical
4882.000	34.18	8.98	38.77	46.18	50.57	74	-23.43	Vertical
6016.949	34.71	10.54	38.94	46.31	52.62	74	-21.38	Vertical
7323.000	35.54	10.72	37.59	42.53	51.20	74	-22.80	Vertical
9764.000	37.10	12.58	36.14	36.69	50.23	74	-23.77	Vertical
12603.270	37.90	14.44	37.75	37.05	51.64	74	-22.36	Vertical
3803.444	32.90	7.74	38.49	46.47	48.62	74	-25.38	Horizontal
4882.000	34.18	8.98	38.77	45.93	50.32	74	-23.68	Horizontal
5999.562	34.70	10.56	38.96	45.90	52.20	74	-21.80	Horizontal
7323.000	35.54	10.72	37.59	41.44	50.11	74	-23.89	Horizontal
9764.000	37.10	12.58	36.14	36.80	50.34	74	-23.66	Horizontal
12585.040	37.89	14.39	37.73	36.91	51.46	74	-22.54	Horizontal

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Worse case mode:	GFSK(DH1)	Test channel:	Highest	Remark:	Peak

Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
3748.808	32.70	7.72	38.47	44.54	46.49	74	-27.51	Vertical
4960.000	34.26	9.09	38.78	45.44	50.01	74	-23.99	Vertical
6016.949	34.71	10.54	38.94	46.62	52.93	74	-21.07	Vertical
7440.000	35.60	10.77	37.54	40.44	49.27	74	-24.73	Vertical
9920.000	37.22	12.67	35.93	37.83	51.79	74	-22.21	Vertical
12603.270	37.90	14.44	37.75	37.35	51.94	74	-22.06	Vertical
3770.567	32.78	7.73	38.47	44.89	46.93	74	-27.07	Horizontal
4960.000	34.26	9.09	38.78	45.54	50.11	74	-23.89	Horizontal
6016.949	34.71	10.54	38.94	46.57	52.88	74	-21.12	Horizontal
7440.000	35.60	10.77	37.54	39.87	48.70	74	-25.30	Horizontal
9920.000	37.22	12.67	35.93	37.70	51.66	74	-22.34	Horizontal
12603.270	37.90	14.44	37.75	37.44	52.03	74	-21.97	Horizontal

Remark:

1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
   Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor
2) Scan from 9kHz to 25GHz,The disturbance above 13GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported .
3) As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.

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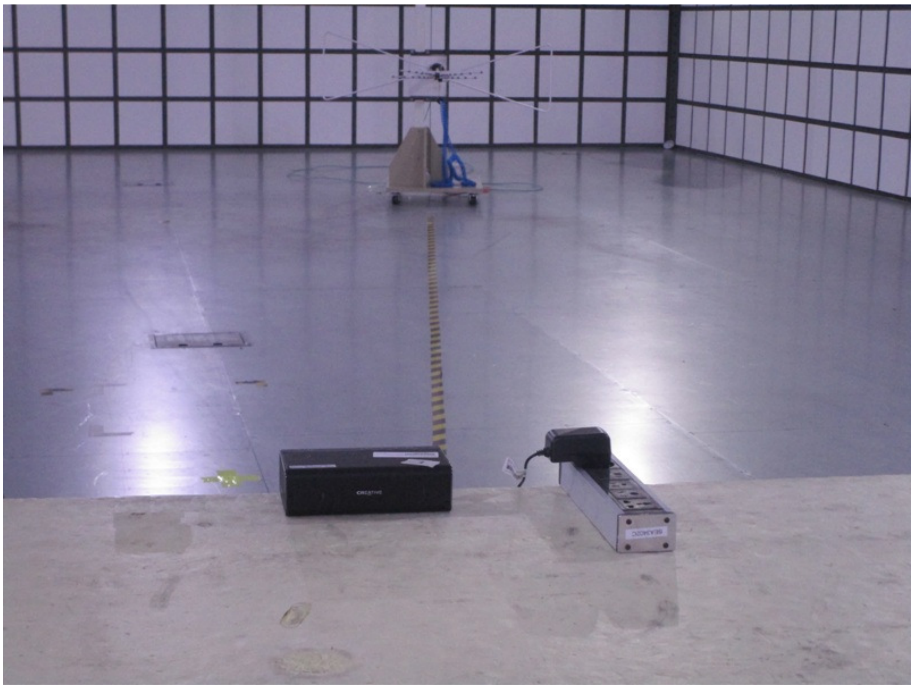
7 Photographs - EUT Test Setup

Test model No.: MF8171

7.1 Conducted Emission

7.2 Radiated Emission



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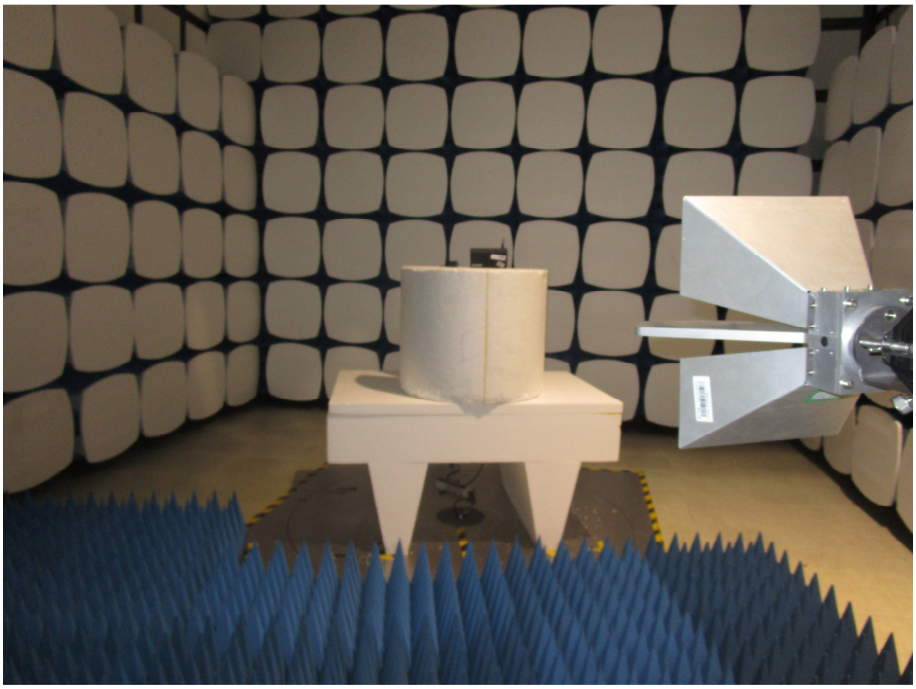
7.3 Radiated Spurious Emission (for frequency>1GHz)



8 Photographs - EUT Constructional Details

Test model No.: MF8171

Refer to Appendix A - Photographs of EUT Constructional Details for SZEM1512007846CR.

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