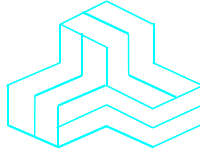


ENGINEERING TEST REPORT



Bluetooth Module – Range Extender

Model: BLERANGEX

FCC ID: 2AFYY-BLERANGEX

Applicant:

Embedded Sense Inc.

5155 Spectrum Way, Unit 17

Mississauga, Ontario

Canada L4W 5A1

In Accordance With

Federal Communications Commission (FCC)

Part 15, Subpart C, Section 15.247

Digital Modulation Systems (DTS) Operating in 2400 – 2483.5 MHz Band

UltraTech's File No.: 16EMSI040_FCC15C247DTS

This Test report is Issued under the Authority of
Tri M. Luu
Vice President of Engineering
UltraTech Group of Labs

Date: September 7, 2016

Report Prepared by: Dan Huynh

Tested by: Hung Trinh

Issued Date: September 7, 2016

Test Dates: August 15-17, 2016

- The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.
- This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.
- This test report shall not be reproduced, except in full, without a written approval from UltraTech

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91038



1309



46390-2049



NVLAP LAB
CODE 200093-0



AT-1945



SL2-IN-E-
1119R



Korea
KCC-RRR

CA2049



TL363_B



TPTDP
DA1300

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EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Part 15, Subpart C, Section 15.247
Title:	Code of Federal Regulations (CFR), Title 47 – Telecommunication, Part 15 – Radio Frequency Devices
Purpose of Test:	Equipment Certification for Digital Modulation Systems (DTS) Transmitter Operating in the Frequency Band 2400-2483.5 MHz.
Test Procedures:	- ANSI C63.4 - ANSI C63.10 - FCC KDB Publication No. 558074 D01 DTS Meas Guidance v03r05
Environmental Classification:	☒ Commercial, industrial or business environment ☒ Residential environment

1.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

1.3. NORMATIVE REFERENCES

Publication	Year	Title
47 CFR Parts 0-19	2016	Code of Federal Regulations (CFR), Title 47 – Telecommunication
ANSI C63.4	2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 GHz
ANSI C63.10	2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
CISPR 22 & EN 55022	2008-09, Edition 6.0 2006	Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement
CISPR 16-1-1 +A1 +A2	2006 2006 2007	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus
CISPR 16-1-2 +A1 +A2	2003 2004 2006	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-2: Conducted disturbances
FCC, KDB Publication No. 558074 D01 DTS Meas Guidance v03r05	2016	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

Applicant	
Name:	Embedded Sense Inc.
Address:	5155 Spectrum Way, Unit 17 Mississauga, Ontario Canada L4W 5A1
Contact Person:	Mr. Frank Gerlach Phone #: 905-282-1750 Fax #: 905-282-9691 Email Address: fgerlach@embeddedsense.com

Manufacturer	
Name:	Embedded Sense Inc.
Address:	5155 Spectrum Way, Unit 17 Mississauga, Ontario Canada L4W 5A1
Contact Person:	Mr. Frank Gerlach Phone #: 905-282-1750 Fax #: 905-282-9691 Email Address: fgerlach@embeddedsense.com

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name:	Embedded Sense Inc.
Product Name:	Bluetooth Module – Range Extender
Model Name or Number:	BLERANGEX
Serial Number:	Test Sample
Type of Equipment:	Digital Transmission System (DTS)
Input Power Supply Type:	External DC Power Supply
Primary User Functions of EUT:	Any application utilizing Bluetooth Low Energy with extended range.

2.3. EUT'S TECHNICAL SPECIFICATIONS

Transmitter	
Equipment Type:	• Portable • Mobile • Base Station (fixed use)
Intended Operating Environment:	▪ Commercial, industrial or business environment ▪ Residential environment
Power Supply Requirement:	3.0 - 3.6. VDC
RF Output Power Rating:	14.49 dBm Peak
Operating Frequency Range:	2402 -2480 MHz
RF Output Impedance:	50 Ω
Duty Cycle:	Continuous
Modulation Type:	GFSK
Antenna Connector Types:	Integral PCB Trace

2.4. ASSOCIATED ANTENNA DESCRIPTIONS

Antenna Type	Maximum Gain (dBi)
PCB Trace antenna	0

2.5. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
No I/O port.				

2.6. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

Ancillary Equipment # 1	
Description:	Test Jig
Brand name:	Embedded Sense Inc.
Model Name or Number:	N/A
Connected to EUT's Port:	I/O Port

EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21 to 23 °C
Humidity:	45 to 58%
Pressure:	102 kPa
Power Input Source:	3.6 VDC

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	The transmitter was operated in a continuous transmission mode with the carrier modulated as specified in the Test Data.
Special Test Software:	Test software provided by the Applicant to operate the EUT at each channel frequency continuously and in the range of typical modes of operation.
Special Hardware Used:	Test Jig
Transmitter Test Antenna:	The EUT is tested with the antenna fitted in a manner typical of normal intended use as integral antenna equipment as described with the test results.

Transmitter Test Signals	
Frequency Band(s):	2402 - 2480 MHz
Frequency(ies) Tested:	2402 MHz, 2440 MHz, 2480 MHz
RF Power Output: (measured maximum output power at antenna terminals)	14.49 dBm Peak
Normal Test Modulation:	GFSK
Modulating Signal Source:	Internal

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).
- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 91038) and Industry Canada office (Industry Canada File No.: 2049A-3). Expiry Date: 2017-04-02.

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Compliance (Yes/No)
15.203	Antenna requirements	Yes
15.207(a)	AC Power Line Conducted Emissions	Yes
15.247(a)(2)	6 dB Bandwidth	Yes
15.247(b)(3)	Peak Conducted Output Power - DTS	Yes
15.247(d)	Band-Edge and RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	Yes
15.247(d), 15.209 & 15.205	Transmitter Spurious Radiated Emissions	Yes
15.247(e)	Power Spectral Density	Yes
15.247(i), 1.1307, 1.1310, 2.1091, 2.1093	RF Exposure	Yes

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

EXHIBIT 5. TEST DATA

5.1. POWER LINE CONDUCTED EMISSIONS [§15.207(a)]

5.1.1. Limit(s)

The equipment shall meet the limits of the following table:

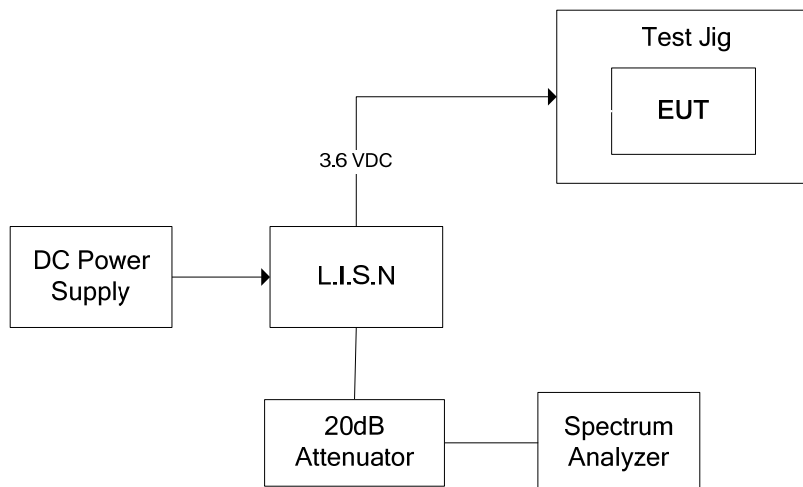
Frequency of emission (MHz)	Conducted Limits (dB μ V)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases linearly with the logarithm of the frequency

5.1.2. Method of Measurements

ANSI C63.4

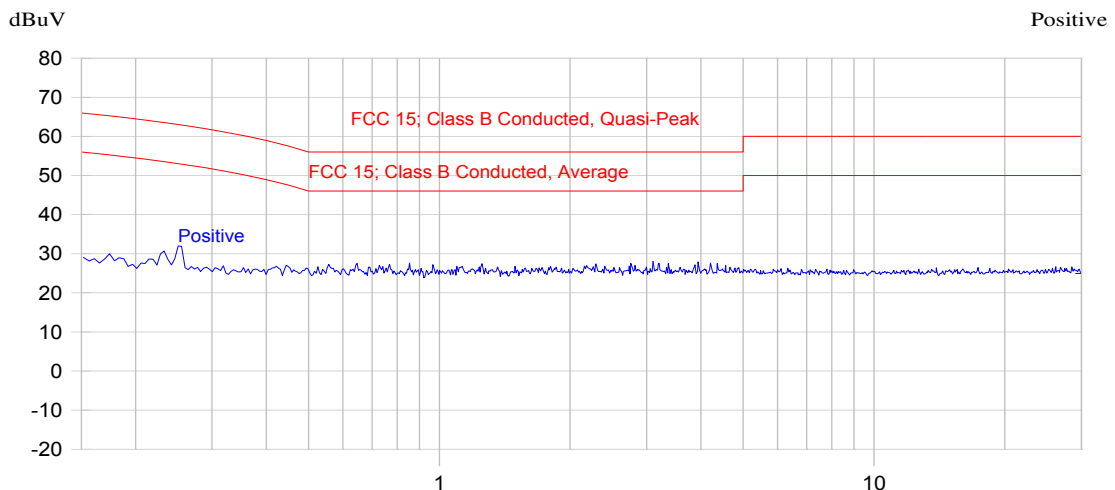
5.1.3. Test Arrangement



5.1.4. Test Data

Plot 5.1.4.1. Power Line Conducted Emissions; Line Voltage: 3.6 VDC; Line Tested: Positive

Current Graph



8/17/2016 9:54:51 AM

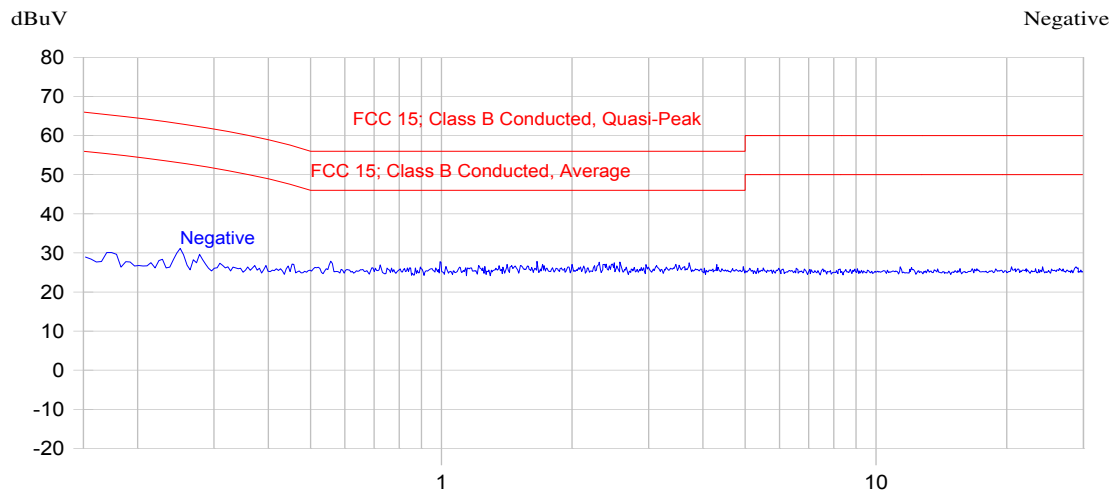
(Start = 0.15, Stop = 30.00) MHz

Current List

Frequency MHz	Peak dBuV	QP dBuV	QP-QP Limit dB	Avg dBuV	Avg-Avg Limit dB	Trace Name
0.249	38.5	33.8	-29.3	26.9	-26.2	Positive

Plot 5.1.4.2. Power Line Conducted Emissions; Line Voltage: 3.6 VDC; Line Tested: Negative

Current Graph



8/17/2016 10:03:21 AM

(Start = 0.15, Stop = 30.00) MHz

Current List

Frequency MHz	Peak dBuV	QP dBuV	QP-QP Limit dB	Avg dBuV	Avg-Avg Limit dB	Trace Name
0.246	37.9	32.3	-30.8	25.1	-28.0	Negative

5.2. OCCUPIED BANDWIDTH [§ 15.247(a)(2)]

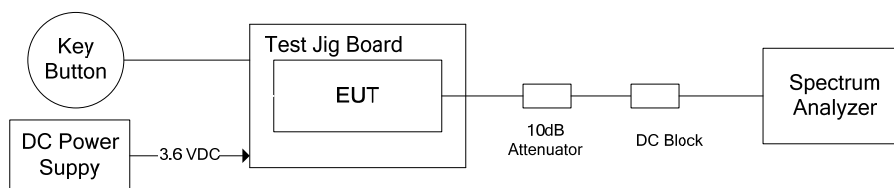
5.2.1. Limit(s)

The minimum 6 dB bandwidth shall be at least 500 kHz.

5.2.2. Method of Measurements

KDB 558074 D01 DTS Meas Guidance v03r05, Section 8.2, Option 2.

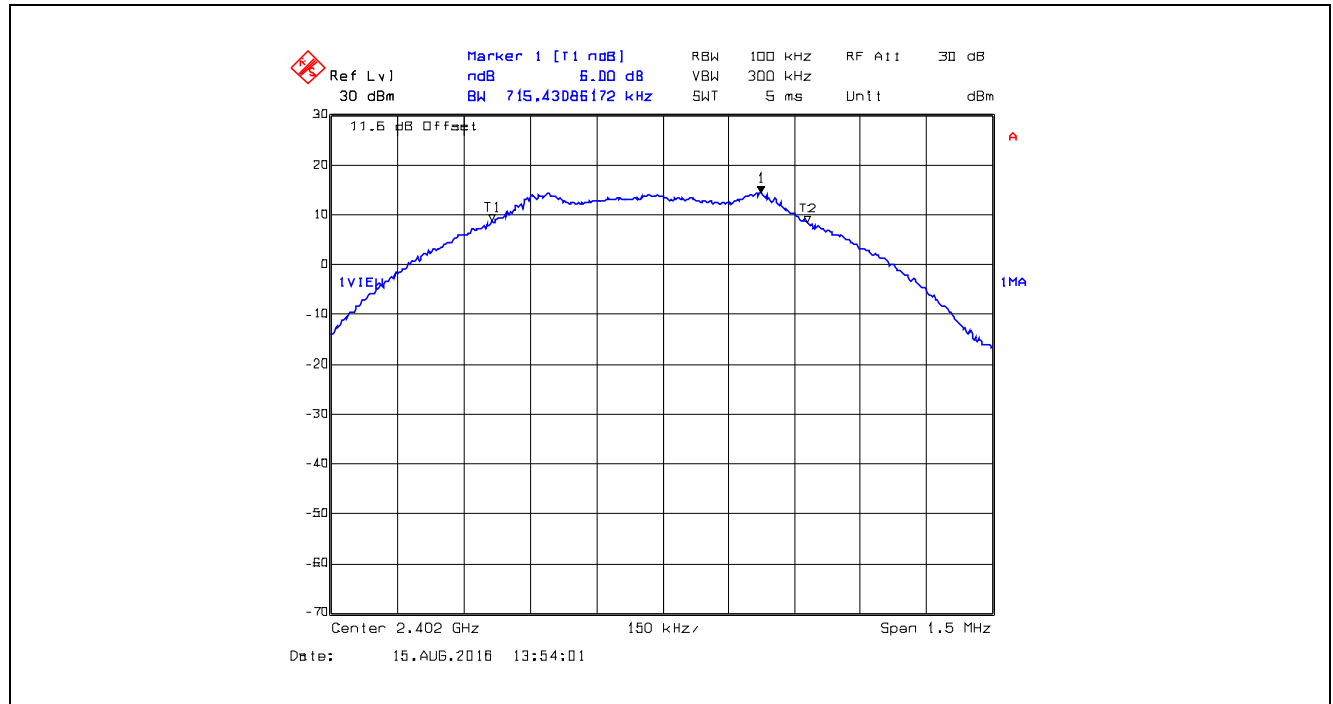
5.2.3. Test Arrangement



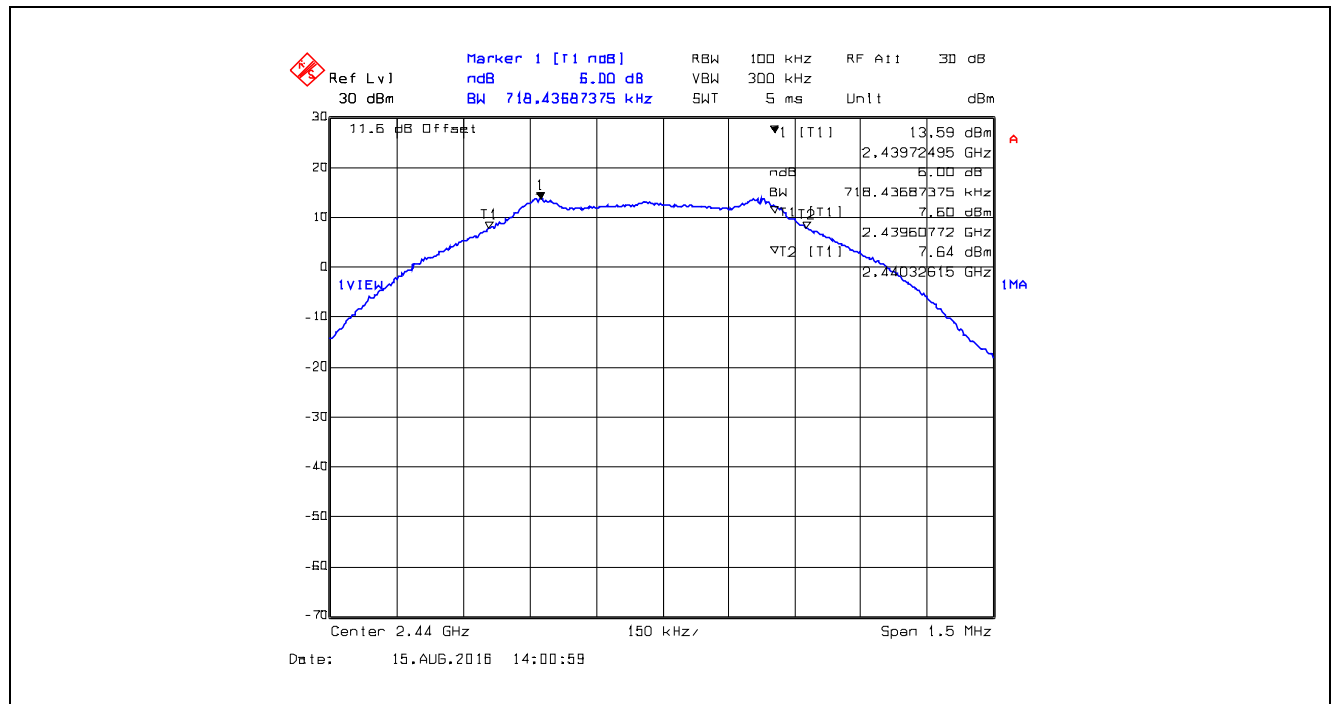
5.2.4. Test Data

Channel	Frequency (MHz)	Modulation	6dB BW (kHz)	Min. Limit (kHz)
1	2402	GFSK	715.43	500
20	2440	GFSK	718.44	500
40	2480	GFSK	721.44	500

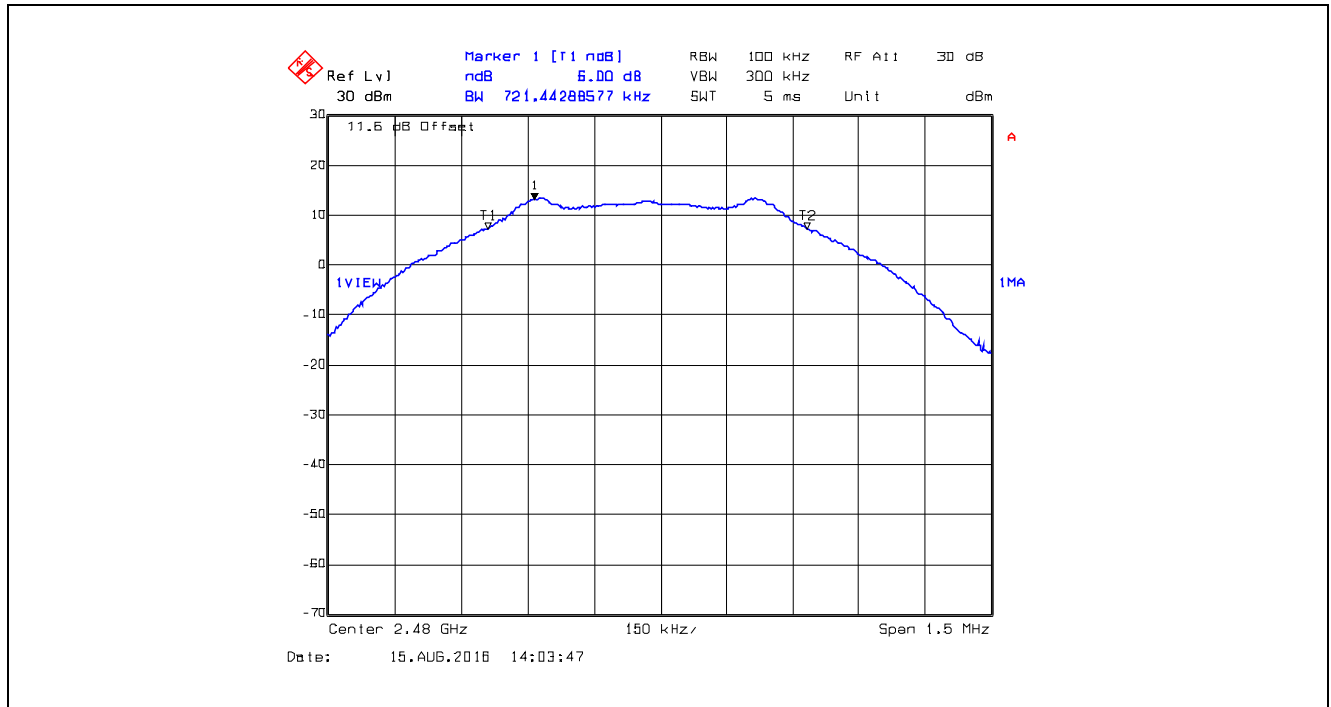
Plot 5.2.4.1. 6 dB Bandwidth, Bandwidth, Channel 1, 2402 MHz, GFSK, 1Mbps, 250 kHz Deviation



Plot 5.2.4.2. 6 dB Bandwidth, Bandwidth, Channel 20, 2440 MHz, GFSK, 1 Mbps, 250 kHz Deviation



Plot 5.2.4.3. 6 dB Bandwidth, Bandwidth, Channel 40, 2480 MHz, GFSK, 1 Mbps, 250 kHz Deviation



ULTRATECH GROUP OF LABS

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File #: 16EMSI040_FCC15C247DTS

September 7, 2016

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

5.3. PEAK CONDUCTED OUTPUT POWER - DTS [§ 15.247(b)]

5.3.1. Limit(s)

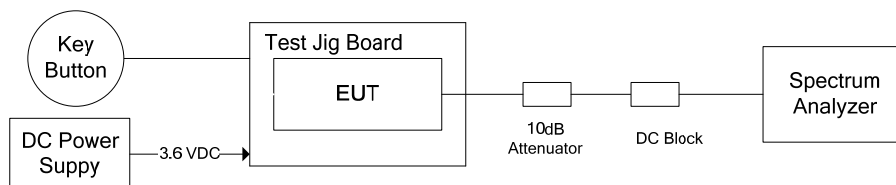
§ 15.247(b)(3): For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

§ 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.

5.3.2. Method of Measurements & Test Arrangement

KDB 558074 D01 DTS Meas Guidance V03r05, Section 9.1.1.

5.3.3. Test Arrangement

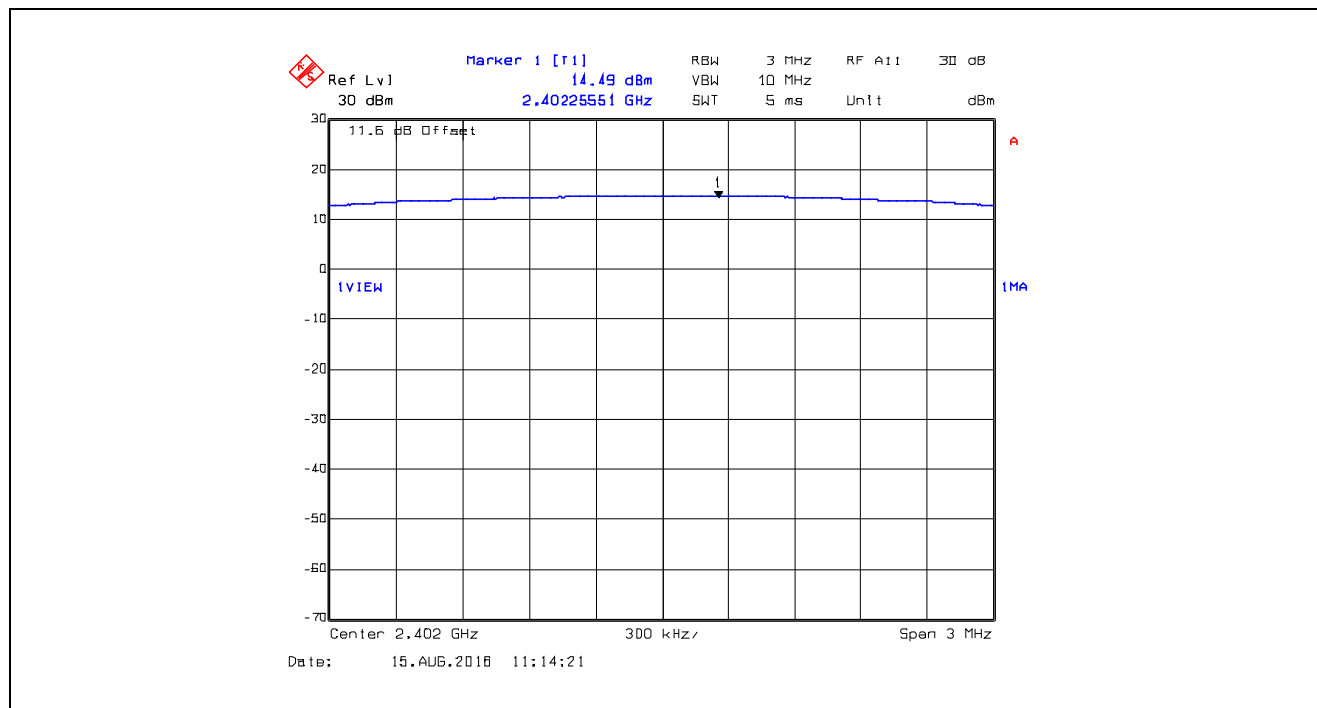


5.3.4. Test Data

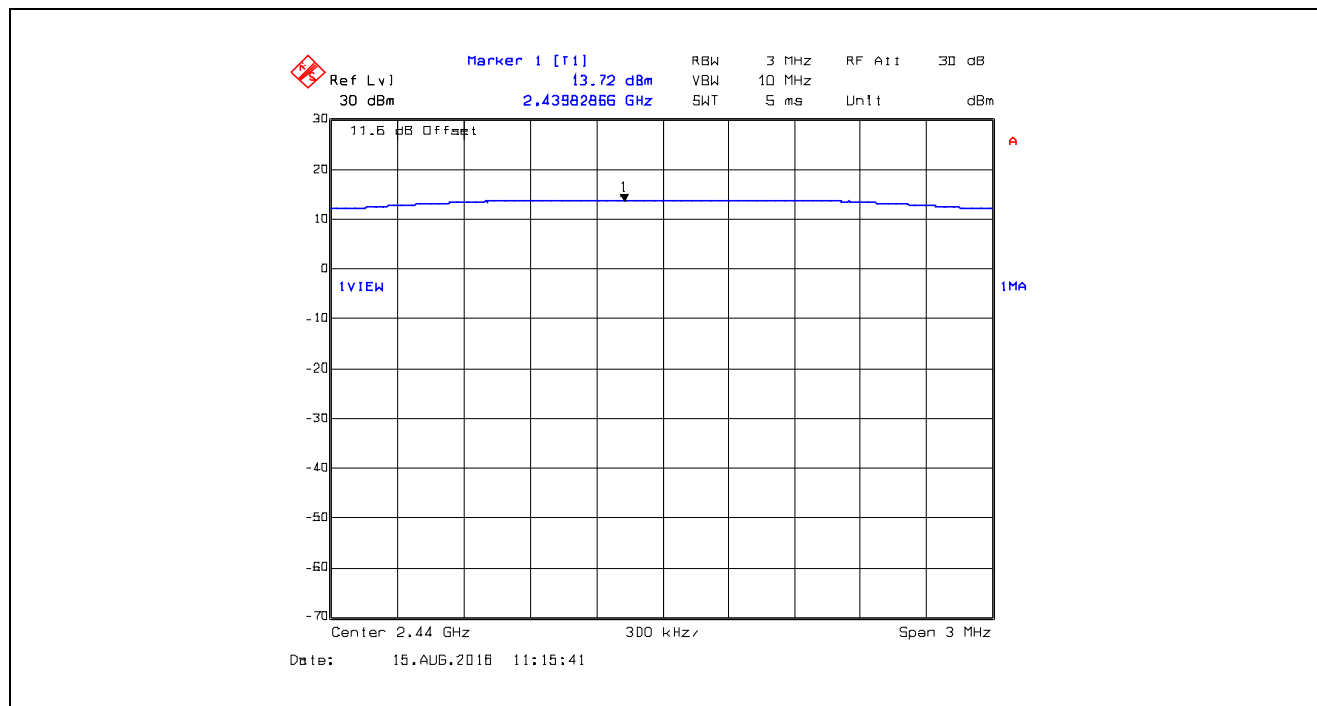
Channel	Frequency (MHz)	Modulation	Peak Power (dBm)	EIRP* (dBm)
1	2402	GFSK	14.49	14.49
20	2440	GFSK	13.72	13.72
40	2480	GFSK	13.34	13.34

* EIRP = Peak Power + Max. Antenna Gain in dBi (0 dBi)

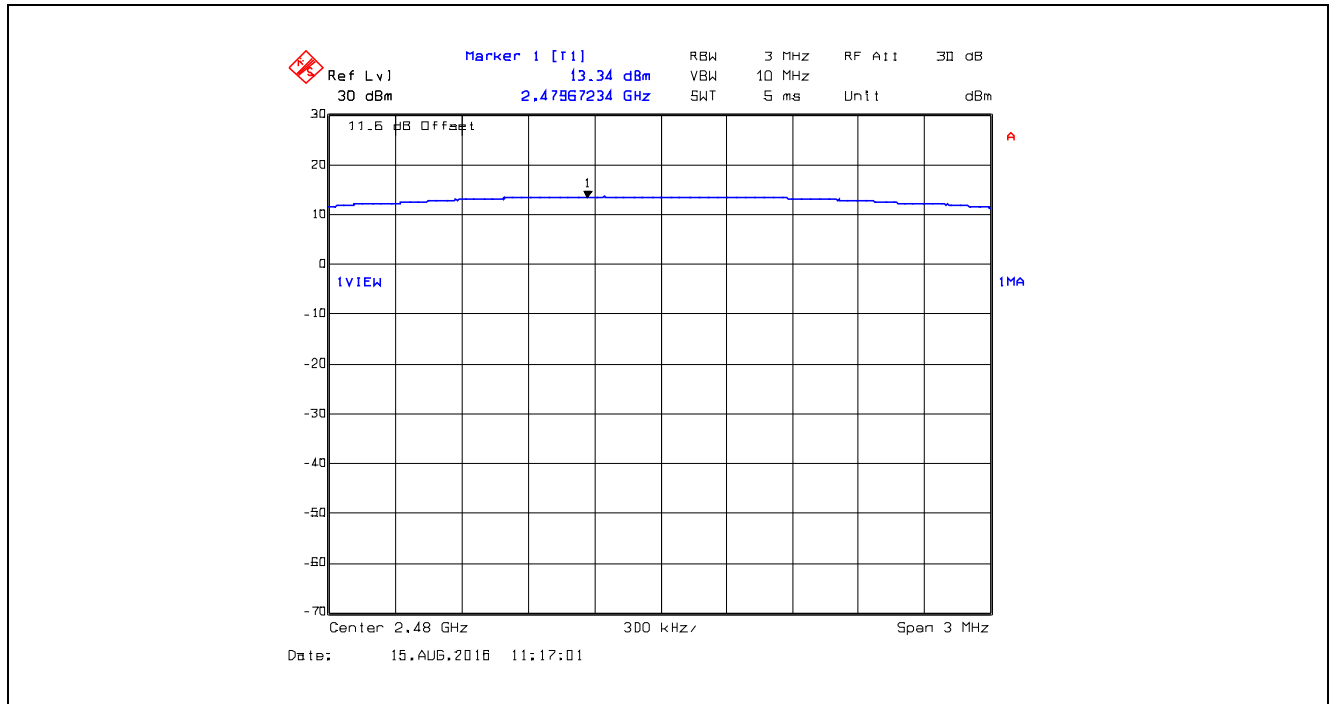
Plot 5.3.4.1. Maximum Peak Conducted Output Power, Channel 1, 2402 MHz, GFSK, 1Mbps, 250 kHz Deviation



Plot 5.3.4.2. Maximum Peak Conducted Output Power, Channel 20, 2440 MHz, GFSK, 1 Mbps, 250 kHz Deviation



Plot 5.3.4.3. Maximum Peak Conducted Output Power, Channel 40, 2480 MHz, GFSK, 1 Mbps, 250 kHz Deviation



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September 7, 2016

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5.4. TRANSMITTER SPURIOUS RADIATED EMISSIONS AT 3 METERS [§§ 15.247(d), 15.209 & 15.205]

5.4.1. Limit(s)

§ 15.247 (d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Section 15.205(a) - Restricted Bands of Operation

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
¹ 0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	(²)
13.36–13.41			

¹ Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.

² Above 38.6

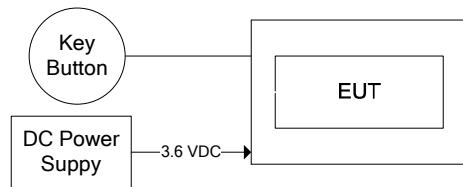
Section 15.209(a) - Field Strength Limits within Restricted Frequency Bands

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2,400 / F (kHz)	300
0.490 - 1.705	24,000 / F (kHz)	30
1.705 - 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
Above 960	500	3

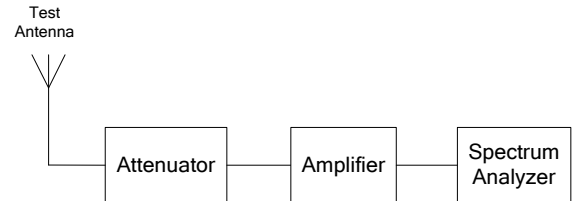
5.4.2. Method of Measurements

ANSI C63.10 and ANSI 63.4 procedures.

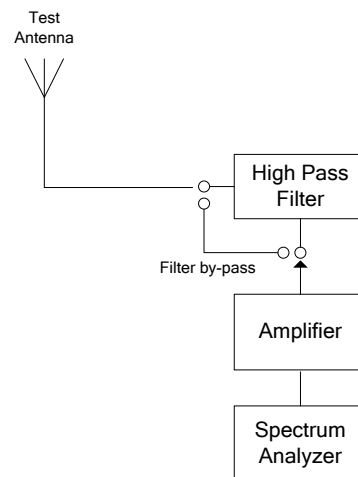
5.4.3. Test Arrangement



For Band-Edge



For Spurious and Harmonics



5.4.4. Test Data

Remark(s):

- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- EUT tested in three orthogonal positions.

5.4.4.1. EUT with 0 dBi PCB Trace Antenna

5.4.4.1.1. Spurious Radiated Emissions

Fundamental Frequency:		2402 MHz					
Measured Conducted Power:		14.49 dBm					
Frequency Test Range:		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dBμV/m)	RF Avg Level (dBμV/m)	Antenna Plane (H/V)	Limit 15.209 (dBμV/m)	Limit 15.247 (dBμV/m)	Margin (dB)	Pass/Fail
2402	108.09	--	V	--	--	--	--
2402	108.06	--	H	--	--	--	--
4804	55.28	49.79	V	54.0	88.1	-4.2	Pass*
4804	55.20	49.73	H	54.0	88.1	-4.3	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

Fundamental Frequency:		2440 MHz					
Measured Conducted Power:		13.72 dBm					
Frequency Test Range:		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dBμV/m)	RF Avg Level (dBμV/m)	Antenna Plane (H/V)	Limit 15.209 (dBμV/m)	Limit 15.247 (dBμV/m)	Margin (dB)	Pass/Fail
2440	107.28	--	V	--	--	--	--
2440	105.25	--	H	--	--	--	--
4880	56.16	50.75	V	54.0	87.3	-3.3	Pass*
4880	55.01	48.22	H	54.0	87.3	-5.8	Pass*
7320	52.46	39.79	V	54.0	87.3	-14.2	Pass*
7320	55.16	39.42	H	54.0	87.3	-14.6	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

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September 7, 2016

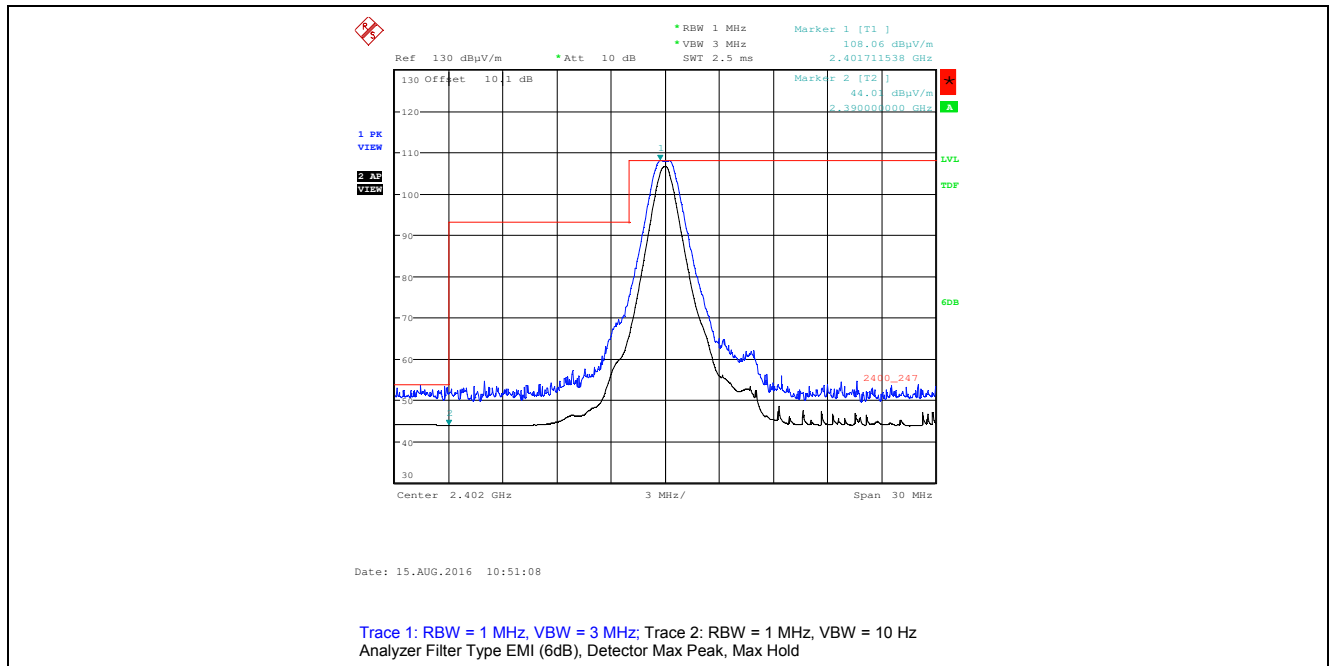
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Fundamental Frequency:		2480 MHz					
Measured Conducted Power:		13.34 dBm					
Frequency Test Range:		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dBμV/m)	RF Avg Level (dBμV/m)	Antenna Plane (H/V)	Limit 15.209 (dBμV/m)	Limit 15.247 (dBμV/m)	Margin (dB)	Pass/Fail
2480	110.50	--	V	--	--	--	--
2480	107.15	--	H	--	--	--	--
4960	52.98	45.65	V	54.0	90.5	-8.4	Pass*
4960	53.15	45.82	H	54.0	90.5	-8.2	Pass*
7440	56.02	41.11	V	54.0	90.5	-12.9	Pass*
7440	55.89	40.25	H	54.0	90.5	-13.8	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

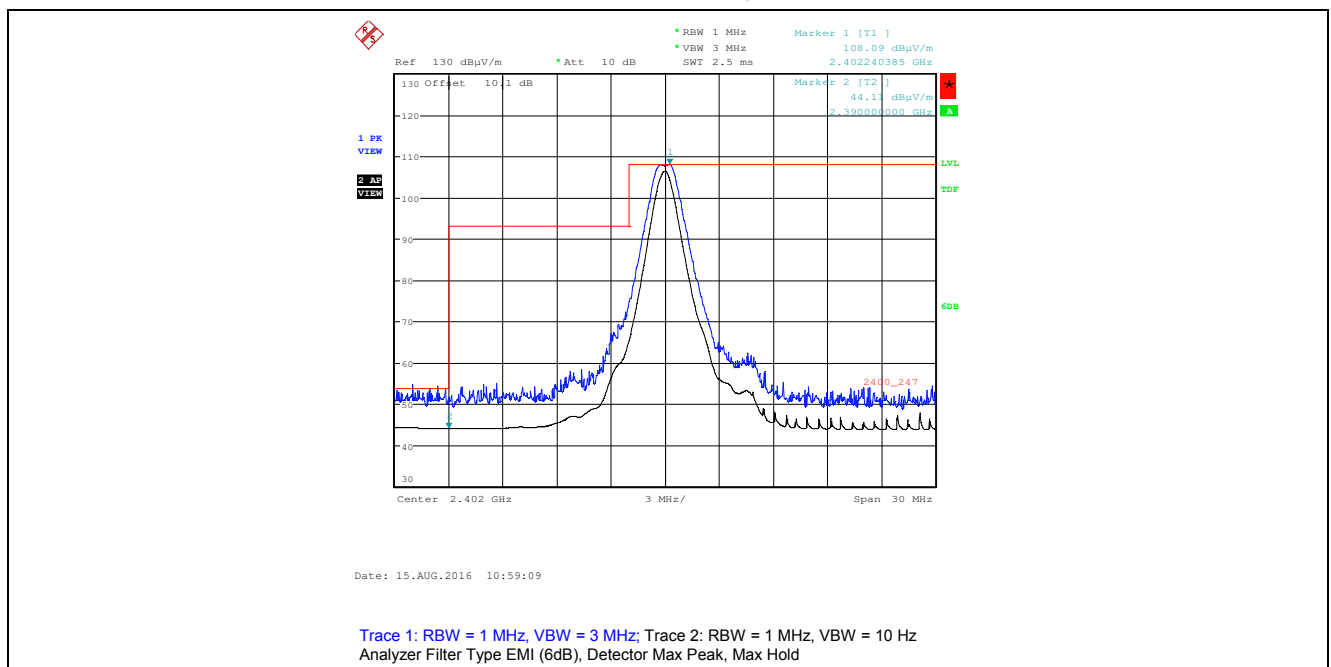
*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

5.4.4.1.2. Band –Edge RF Radiated Emissions

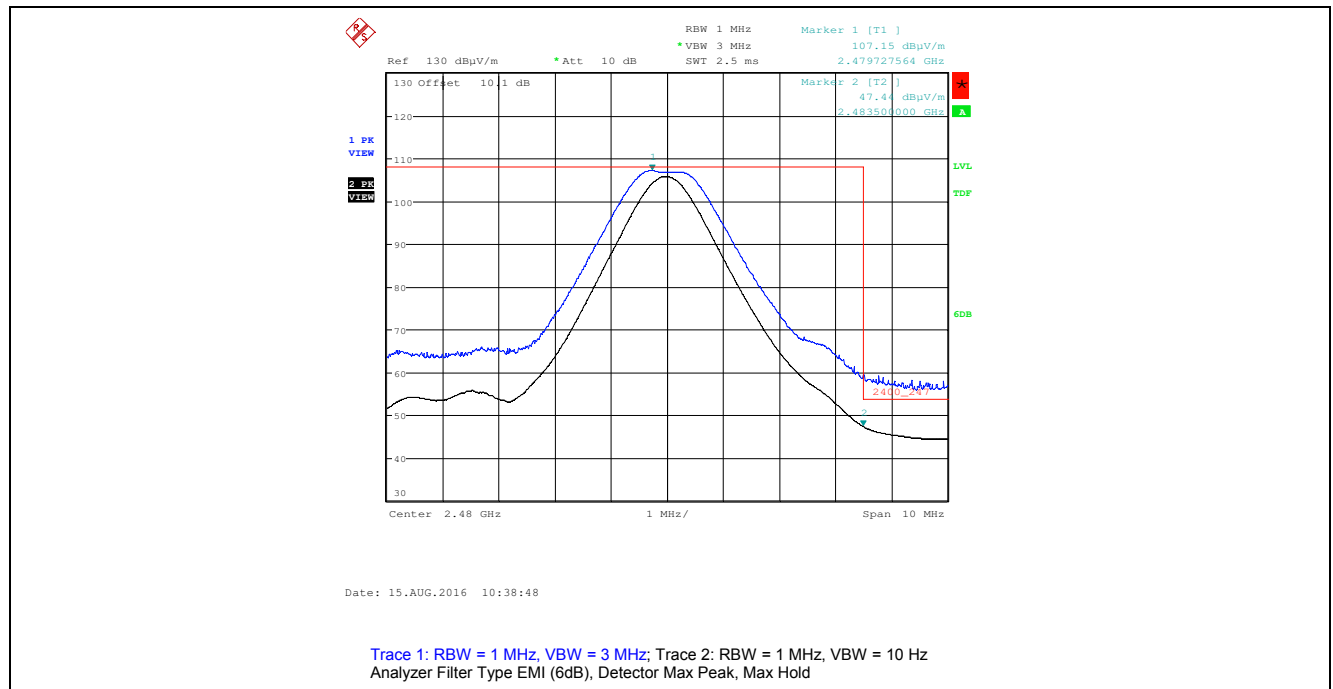
Plot 5.4.4.1.2.1. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
Low End of Frequency Band



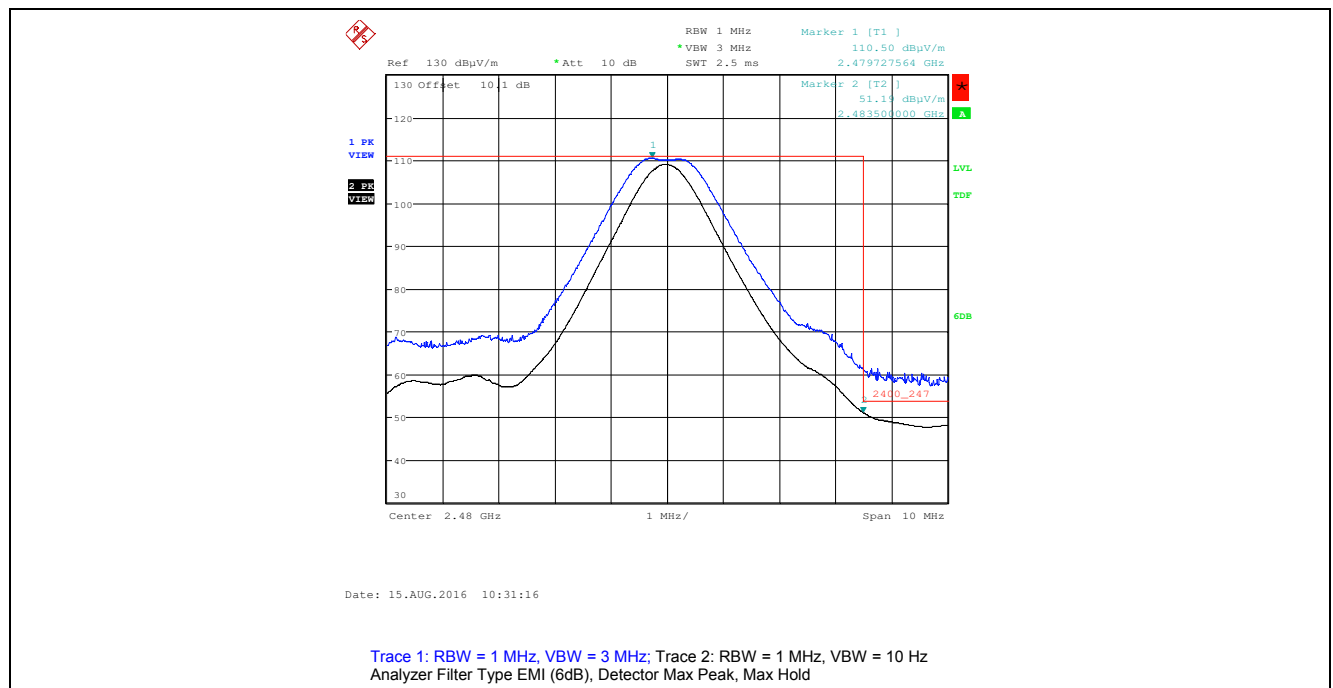
Plot 5.4.4.1.2.2. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
Low End of Frequency Band



Plot 5.4.4.1.2.3. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
High End of Frequency Band



Plot 5.4.4.1.2.4. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
High of Frequency Band



5.5. POWER SPECTRAL DENSITY [§ 15.247(e)]

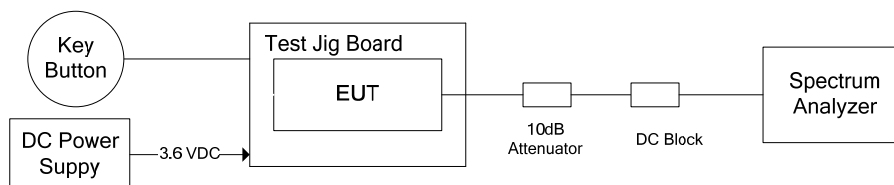
5.5.1. Limit(s)

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

5.5.2. Method of Measurements

KDB 558074 D01 DTS Meas Guidance v03r05, Section 10.2 Peak PSD.

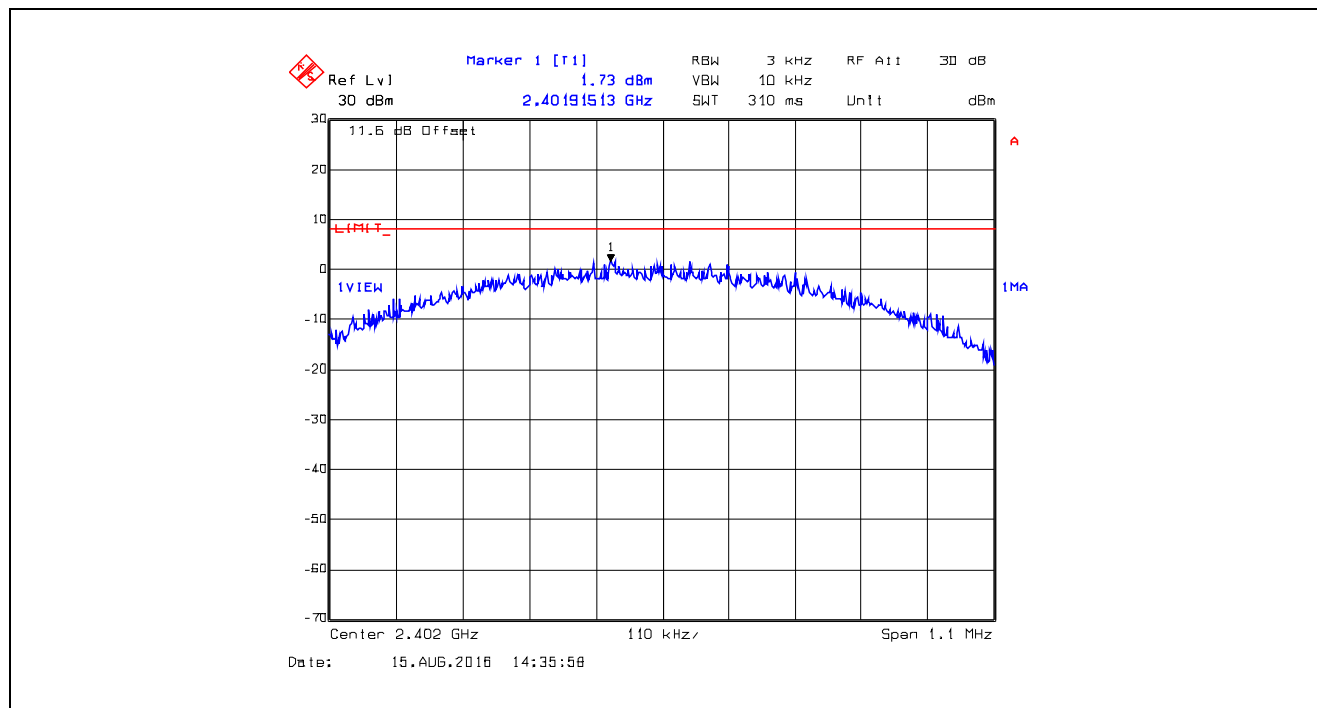
5.5.3. Test Arrangement



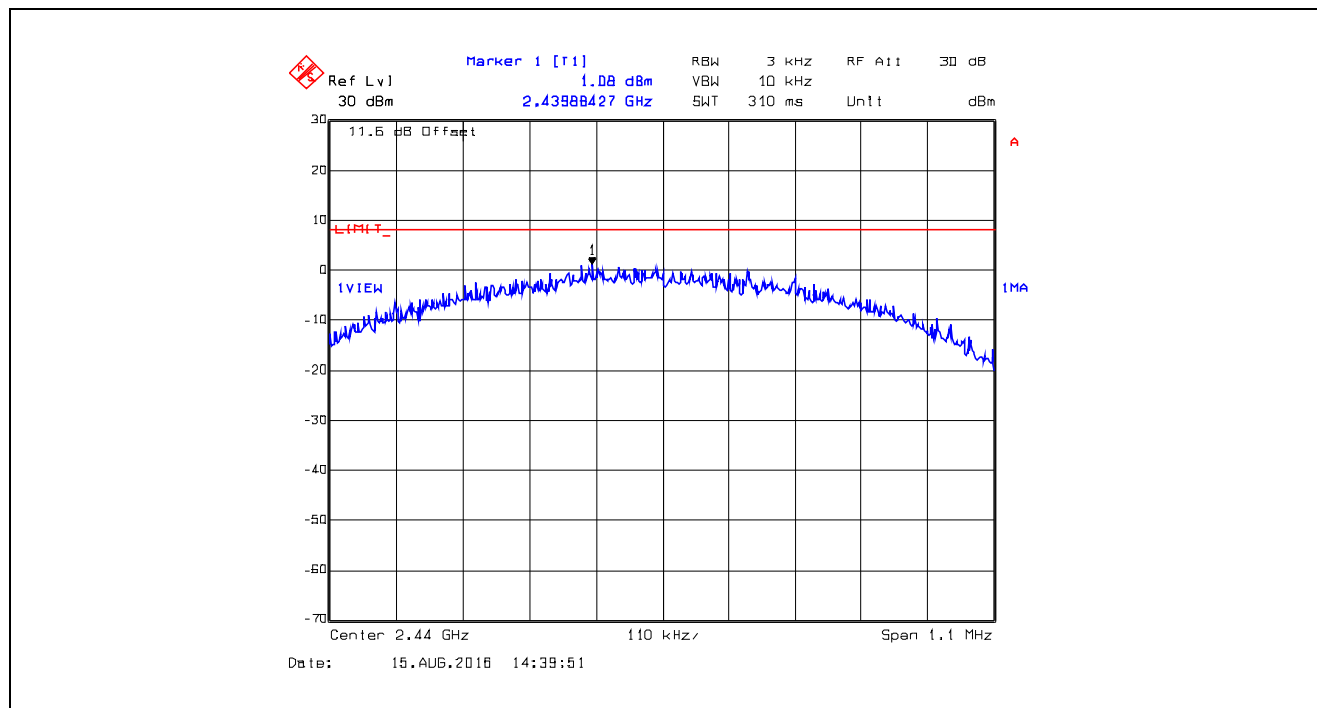
5.5.4. Test Data

Channel	Frequency (MHz)	Modulation	PSD (dBm)	Limit (dBm)
1	2402	GFSK	1.73	8
20	2440	GFSK	1.08	8
40	2480	GFSK	0.33	8

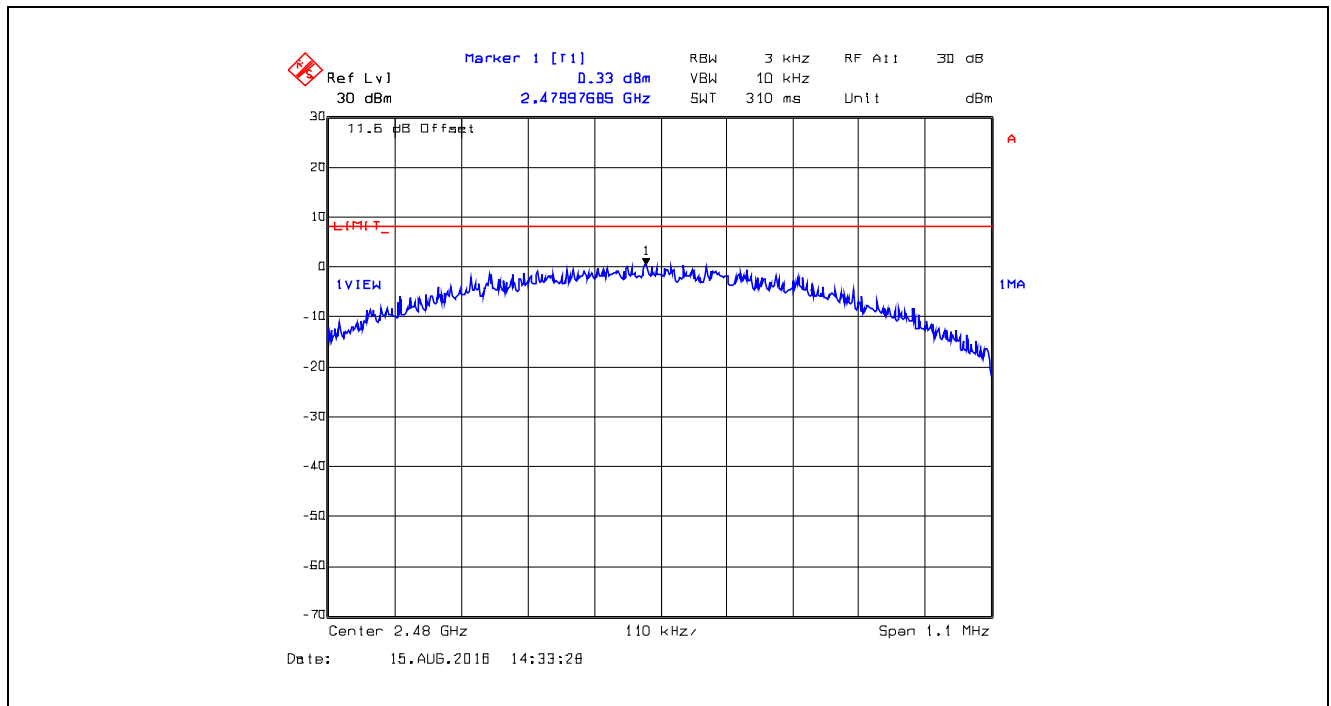
Plot 5.5.4.1. Power Spectral Density, Bandwidth Channel 1, 2402 MHz, GFSK, 1 Mbps, 250 kHz Deviation



Plot 5.5.4.2. Power Spectral Density, Bandwidth Channel 20, 2440 MHz, GFSK, 1 Mbps, 250 kHz Deviation



Plot 5.5.4.3. Power Spectral Density, Bandwidth Channel 40, 2480 MHz, GFSK, 1 Mbps, 250 kHz Deviation



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5.6. RF EXPOSURE REQUIRMENTS [§§ 15.247(i), 1.1310 & 2.1091]

5.6.1. Limits

§ 1.1310: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b).

Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f ²)	6
30-300	61.4	0.163	1.0	6
300-1500			f/300	6
1500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500			f/1500	30
1500-100,000			1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

Note 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

Note 2: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

5.6.2. Method of Measurements

Calculation Method of Power Density/RF Safety Distance:

$$S = \frac{PG}{4\pi \cdot r^2} = \frac{EIRP}{4\pi \cdot r^2}$$

Where,
P: power input to the antenna in mW
EIRP: Equivalent (effective) isotropic radiated power.
S: power density mW/cm²
G: numeric gain of antenna relative to isotropic radiator
r: distance to centre of radiation in cm

5.6.3. RF Evaluation

5.6.3.1. Standalone

For Portable Application				
Pursuant to FCC KDB 447498 D01 General RF Exposure Guidance v06, Section 4.3.1. Standalone SAR test exclusion considerations a) For 100 MHz to 6 GHz and <i>test separation distances</i> ≤ 50 mm, the 1-g and 10-g <i>SAR test exclusion thresholds</i> are determined by the following: $[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f_{(\text{GHz})}}] \leq 3.0$ for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR, where $f_{(\text{GHz})}$ is the RF channel transmit frequency in GHz				
Max. power of channel, including tune-up tolerance, mW	Min. test separation distance, mm	$f_{(\text{GHz})}$	Calculated 1-g (head or boby) SAR test exclusion threshold	1-g (head or boby) SAR test exclusion threshold limit
28.119	20	2.480	2.2	3.0
Conclusion: The EUT qualify for SAR test exclusion at an evaluated separation distance of 20 mm, the calculated 1-g SAR test exclusion threshold is $2.2 \leq 3.0$.				

5.6.3.2. Co-location for Mobile Device

Pursuant to KDB 447498 D01 General RF Exposure Guidance v06, Section 7.2:

Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in a host device is ≤ 1.0 , according to calculated/estimated, numerically modeled, or measured field strengths or power density.

The maximum calculated MPE ratio of the EUT with 0 dBi PCB Trace Antenna

Frequency (MHz)	EUT EIRP (dBm)	EUT EIRP (mW)	Evaluation Distance (cm)	Power Density (mW/cm ²)	FCC MPE Limit (mW/cm ²)	MPE Ratio
2402	14.49	28.119	20	0.00559	1.0	0.00559

The maximum calculated MPE ratio for the EUT with 0 dBi PCB Trace Antenna is 0.00559, this configuration can be co-located with other antennas provided the sum of the MPE ratios for all the other simultaneous transmitting antennas incorporated in a host device is $\leq 1.0 - 0.00559 \leq 0.99441$.

EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
Spectrum Analyzer	Hewlett Packard	HP 8593EM	3412A00103	9 kHz–26.5 GHz	09 Apr 2017
Attenuator	Pasternack	PE7010-20	-	DC–2 GHz	03 Feb 2017
L.I.S.N	EMCO	3825/2	2209	0.10 -100 MHz	29 Sep 2016
DC Power Supply	Xantrex	HPD 60-5SX	63903	0 – 60 VDC	Cal on use
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20Hz–40 GHz	21 Nov 2016
Attenuator	Pasternack	7024-20	6	DC–26.5 GHz	Cal on use
DC Block	Hewlett Packard	11742A	12460	0.045 – 26.5 GHz	Cal on use
Spectrum Analyzer	Rohde & Schwarz	FSU26	200946	20Hz–26.5 GHz	21 Jul 2018
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz	05 May 2017
Attenuator	Pasternack	7024-10	4	DC–26.5 GHz	Cal on use
Horn Antenna	EMCO	3155	5955	1 – 18 GHz	21 Apr 2017
EMI Receiver	Rohde & Schwarz	ESU40	100037	20 Hz–40 GHz	08 May 2017
RF Amplifier	Com-Power	PAM-0118A	551016	0.5 – 18 GHz	14 Jul 2017
Biconilog	EMCO	3142	9601-1005	26-1000 MHz	12 May 2017
Horn Antenna	EMCO	3160-09	118385	18 – 26.5 GHz	04 Aug 2016
High Pass Filter	K & L	11SH10-4000/T12000	4	Cut off 2400 MHz	Cal on use

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EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.

7.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

	Line Conducted Emission Measurement Uncertainty (9 kHz – 30 MHz):	Measured	Limit
u_c	Combined <u>standard</u> uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	± 1.44	± 1.8
U	Expanded uncertainty U : $U = 2u_c(y)$	± 2.89	± 3.6

7.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

	Radiated Emission Measurement Uncertainty @ 3m, Horizontal (30-1000 MHz):	Measured (dB)	Limit (dB)
u_c	Combined <u>standard</u> uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	± 2.39	± 2.6
U	Expanded uncertainty U : $U = 2u_c(y)$	± 4.79	± 5.2

	Radiated Emission Measurement Uncertainty @ 3m, Vertical (30-1000 MHz):	Measured (dB)	Limit (dB)
u_c	Combined <u>standard</u> uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	± 2.39	± 2.6
U	Expanded uncertainty U : $U = 2u_c(y)$	± 4.78	± 5.2

	Radiated Emission Measurement Uncertainty @ 3 m, Horizontal & Vertical (1 – 18 GHz):	Measured (dB)	Limit (dB)
u_c	Combined <u>standard</u> uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	± 1.87	Under consideration
U	Expanded uncertainty U : $U = 2u_c(y)$	± 3.75	Under consideration