Bluetooth 4.0 (Low Energy)

FCC / IC Test Report

FOR:

Intel Corporation

Model Name: DZ110

Product Description: Smartphone with GSM/GPRS/EDGE, UMTS/HSPA+/LTE, Wi-Fi, BT, NFC and GPS Radios

FCC ID: O2Z-DZ110
IC ID: 1000W – DZ110

47 CFR Part 15.247 (DTS)

RSS-210 Issue 8 Annex 8

TEST REPORT #: EMC_INTEL_039_14001_15.247BTLE
DATE: 2014-06-12

ACCREDITED
TESTING LABORATORY
Certificate #2135.01

Bluetooth Qualification Test Facility (BQTF)

CTIA Authorized Test Lab
LAB CODE 20020328-00

FCC listed
A2LA Accredited

IC recognized # 3462B

***CETECOM* Inc.**
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CETECOM Inc. is a Delaware Corporation with Corporation number: 2113686

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1 Assessment

The following device was evaluated against the applicable criteria specified in FCC rules Parts 15.247 of Title 47 of the Code of Federal Regulations and IC standard RSS-210 issue 8, Annex 8 and no deviations were ascertained during the course of the tests performed.

Company	Description	Model #
Intel Corporation	Smartphone with GSM/GPRS/EDGE, UMTS/HSDP+/LTE, Wi-Fi, BT, NFC and GPS Radios	DZ110

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2014-06-12	Compliance	Franz Engert (Compliance Manager)	Digitally signed by Franz Engert DN: cn=Franz Engert, c=US, o=CETECOM, ou=Compliance, email=franz.engert@cetecom.com Date: 2014.06.12 16:43:49 -07'00'

Responsible for the Report:

Date	Section	Name	Signature
2014-06-12	Compliance	Danh Le (EMC Engineer)	Digitally signed by Danh Le DN: cn=Danh Le, o=Cetecom, ou=Compliance, email=danh.le@cetecom.com, c=US Date: 2014.06.12 19:33:37 -07'00'

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Address:	411 Dixon Landing Road Milpitas, CA 95035 U.S.A.
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Compliance Manager:	Franz Engert
Responsible Project Leader:	Danh Le

2.2 Identification of the Client

Applicant's Name:	Intel Corporation
Street Address:	2200 Mission College Blvd
City/Zip Code	Santa Clara / 95054
Country	USA
Contact Person:	Christine Ryan
Phone No.	408 300 2167
Fax:	408-765-2336
e-mail:	Christine.m.ryan@intel.com

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as Applicant
Manufacturers Address:	---
City/Zip Code	---
Country	---

2.1 Testing Period:

04/30/2014 -02/06/2014

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Marketing Name / Model No:	Intel 4.5-inch Premium LTE Smartphone / DZ110
HW / SW Revision :	PR2D.2
FCC-ID / IC-ID:	O2Z-DZ110 / 1000W- DZ110
Product Description:	Smartphone with multiband GSM/GPRS/EDGE, UMTS/HSPA+, LTE, WLAN 802.11 a/b/g/n/ac, Bluetooth, NFC and GPS
Technology / Type(s) of Modulation:	Bluetooth v4.0, LE, using FHSS with GFSK
Operating Frequency Ranges (MHz) / Channels:	Nominal band: 2400 – 2483.5; Center to center: 2402(ch 0) – 2480(ch 39), 40 channels
Antenna info:	Internal Monopole Documented max antenna gain(2.4GHz) = -5.5dBi
Max. Output Power:	Peak Conducted: 7.81dBm (6.04 mW);
Rated Operating Voltage Range / Power Supply:	Vmin: 3.6V/ Vnom: 3.8V/ Vmax: 4.35V; AA lithium battery pack (dedicated)
Rated Operating Temperature Range:	-10ºC to 55ºC
Other Radios included in the device:	1. Intel XMM 7160 Radio Module • GSM 850/900/1800/1900MHz GPRS / EDGE Multi-slot class 33 operation • WCDMA / HSPA+ 850/900/1700/1900/2100 MHz • LTE 700/800/850/900/1700/1800/1900/2100/2600 2. Wi-Fi (2.4 GHz and 5GHz), BT EDR (2.4 GHz), 3. GPS 1575.42 MHz 4. NFC NXP PN547 13.56 MHz
EUT status	Prototype

3.2 Identification of the Equipment under Test (EUT)

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	INV133601723	PR2D.2	SB SB JB r43-main-weekly-973 (WW46)	Radiated and Conducted RF Sample
2	INV133600961	PR2D.2	SB SB JB r43-main-weekly-973 (WW46)	AC Conducted Sample

3.3 Identification of Accessory equipment

STE #	Type	Manufacturer	Model	Serial Number
1	AC/DC Adapter	Solcomp	SC1402	12374000330319

3.4 Test mode of operation:

Mode	Data rate (Mbps)	Modulation scheme
802.15 BTLE	1.0	GFSK

4 Subject Of Investigation

The objective of the measurements done by Cetecom Inc. was to measure the performance of the EUT as specified by requirements listed in FCC rules Part 15.247 of Title 47 of the Code of Federal Regulations and Radio Standard Specification RSS-210 Issue 8, Annex 8 of Industry Canada.

This test report is to support a request for new equipment authorization under the FCC ID **O2Z-DZ110.** All testing was performed on the product referred to in Section 3 as EUT.

During the testing process the EUT was tested on low, mid and high channels for all the supported modes of operation. For radiated measurements, all data in this report shows the worst case between horizontal and vertical antenna polarizations and for all orientations of the EUT.

5 Summary of Measurement Results

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§15.247(e) RSS210 A8.2(b)	Power Spectral Density	Nominal	802.15 (LE)	■	☐	☐	☐	Complies
§15.247(a)(1) RSS210 A8.2(a)	Emission Bandwidth	Nominal	802.15 (LE)	■	☐	☐	☐	Complies
§15.247(b)(1) RSS210 A8.4(4)	Maximum Peak Conducted Output Power and EIRP	Nominal	802.15 (LE)	■	☐	☐	☐	Complies
§15.247(d) RSS210 A8.5	Band edge compliance	Nominal	802.15 (LE)	■	☐	☐	☐	Complies
§15.247(d) §15.209 RSS210 A8.5	TX Spurious emissions-Conducted	Nominal	802.15 (LE)	☐	☐	☐	■	1
§15.247(d) §15.209 RSS210 A8.5 RSS-Gen 7.2.2	TX Spurious emissions-Radiated	Nominal	802.15 (LE)	■	☐	☐	☐	Complies
§15.207(a) RSS Gen 7.2.4	AC Conducted Emissions	Nominal	802.15 (LE)	■	☐	☐	☐	Complies

Note: NA= Not Applicable; NP= Not Performed.

1. Conducted spurious emissions test against non-restricted band limits is NOT PERFORMED since radiated spurious emissions against more stringent restricted band limits over the complete measurement range (9kHz to 26GHz) is passed.

6 Measurements

6.1 Radiated Measurement Procedure

ANSI C63.10 (2009) Section 8.3.1.1: Exploratory radiated emission measurements

Exploratory radiated measurements shall be performed at the measurement distance or at a closer distance than that specified for compliance to determine the emission characteristics of the EUT. At near distances, for EUTs of comparably small size, it is relatively easy to determine the spectrum signature of the EUT and, if applicable, the EUT configuration that produces the maximum level of emissions. A shielded room may be used for exploratory testing, but may have anomalies that can lead to significant errors in amplitude measurements.

Broadband antennas and a spectrum analyzer or a radio-noise meter with a panoramic display are often useful in this type of testing. It is recommended that either a headset or loudspeaker be connected as an aid in detecting ambient signals and finding frequencies of significant emission from the EUT when the exploratory and final testing is performed in an OATS with strong ambient signals. Caution should be taken if either antenna height between 1 and 4 meters or EUT azimuth is not fully explored. Not fully exploring these parameters during exploratory testing may require complete testing at the OATS or semi-anechoic chamber when the final full spectrum testing is conducted.

The EUT should be set up in its typical configuration and arrangement, and operated in its various modes. For tabletop systems, cables or wires should be manipulated within the range of likely arrangements. For floor-standing equipment, the cables or wires should be located in the same manner as the user would install them and no further manipulation is made. For combination EUTs, the tabletop and floor-standing portions of the EUT shall follow the procedures for their respective setups and cable manipulation. If the manner of cable installation is not known, or if it changes with each installation, cables or wires for floor-standing equipment shall be manipulated to the extent possible to produce the maximum level of emissions.

For each mode of operation required to be tested, the frequency spectrum shall be monitored. Variations in antenna height between 1 and 4 m, antenna polarization, EUT azimuth, and cable or wire placement (each variable within bounds specified elsewhere) shall be explored to produce the emission that has the highest amplitude relative to the limit. A step-by-step technique for determining this emission can be found in Annex C.

When measuring emissions above 1 GHz, the frequencies of maximum emission shall be determined by manually positioning the antenna close to the EUT and by moving the antenna over all sides of the EUT while observing a spectral display. It will be advantageous to have prior knowledge of the frequencies of emissions above 1 GHz. If the EUT is a device with dimensions approximately equal to that of the measurement antenna beamwidth, the measurement antenna shall be aligned with the EUT.

ANSI C63.10 (2009) Section 8.3.1.2: Final radiated emission measurements

Based on the measurement results in 8.3.1.1, the one EUT, cable and wire arrangement, and mode of operation that produces the emission that has the highest amplitude relative to the limit is selected for the final measurement. The final measurement is then performed on a site meeting the requirements of 5.3, 5.4, or 5.5 as appropriate without variation of the EUT arrangement or EUT mode of operation. If the EUT is relocated from an exploratory test site to a final test site, the highest emission shall be remaximized at the final test location before final radiated emissions measurements are performed. However, antenna height and polarity and EUT azimuth are to be varied. In addition, the full frequency spectrum (for the range to be checked for meeting compliance) shall be investigated.

This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. During the full frequency spectrum investigation, particular focus should be made on those frequencies found in exploratory testing that were used to find the final test configuration, mode of operation, and arrangement (associated with achieving the least margin with respect to the limit). This full spectrum test constitutes the compliance measurement.

For measurements above 1 GHz, use the cable, EUT arrangement, and mode of operation determined in the exploratory testing to produce the emission that has the highest amplitude relative to the limit. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the antenna in the "cone of radiation" from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response. The antenna may have to be higher or lower than the EUT, depending on the EUT's size and mounting height, but the antenna should be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. If the transmission line for the measurement antenna restricts its range of height and polarization, the steps needed to ensure the correct measurement of the maximum emissions, shall be described in detail in the report of measurements. Data collected shall satisfy the report requirements of Clause 10.

NOTES

1— Where limits are specified by agencies for both average and peak (or quasi-peak) detection, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.
2—Use of waveguide and flexible waveguide may be necessary at frequencies above 10 GHz to achieve usable signal-to noise ratios at required measurement distances. If so, it may be necessary to restrict the height search of the antenna, and special care should be taken to ensure that maximum emissions are correctly measured.
3—All presently known devices causing emissions above 10 GHz are physically small compared with the beam-widths of typical horn antennas used for EMC measurements. For such EUTs and frequencies, it may be preferable to vary the height and polarization of the EUT instead of the receiving antenna to maximize the measured emissions.

Radiated Measurement Uncertainty: ±3dB

6.1.1 Sample Calculations for Radiated Measurements

Measurements from the Spectrum Analyzer/ Receiver are used to calculate the Field Strength, taking into account the following parameters:

1. Measured reading in dBµV
2. Cable Loss between the receiving antenna and SA in dB and
3. Antenna Factor in dB/m

FS (dBµV/m) = Measured Value on SA (dBµV)+ Cable Loss (dB)+ Antenna Factor (dB/m)
Eg:

Frequency (MHz)	Measured SA (dBµV)	Cable Loss (dB)	Antenna Factor Correction (dB)	Field Strength Result (dBµV/m)
1000	80.5	3.5	14	98.0

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the above equation.

6.2 Conducted Emissions Procedure

ANSI C63.10 (2009) Section 6.2.5: Final AC Power-Line Conducted Emission Measurements

Based on the exploratory tests of the EUT performed in 6.2.4, the one EUT cable configuration and arrangement and mode of operation that produced the emission with the highest amplitude relative to the limit is selected for the final measurement, while applying the appropriate modulating signal to the EUT. If the EUT is relocated from an exploratory test site to a final test site, the highest emissions shall be remaximized at the final test location before final ac power-line conducted emission measurements are performed. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment in the system) is then performed for the full frequency range for which the EUT is being tested for compliance without further variation of the EUT arrangement, cable positions, or EUT mode of operation. If the EUT is comprised of equipment units that have their own separate ac power connections, e.g., floor-standing equipment with independent power cords for each shelf that are able to connect directly to the ac power network, each current-carrying conductor of one unit is measured while the other units are connected to a second (or more) LISN(s). All units shall be separately measured. If a power strip is provided by the manufacturer, to supply all of the units making up the EUT, only the conductors in the power cord of the power strip shall be measured.

If the EUT uses a detachable antenna, these measurements shall be made with a suitable dummy load connected to the antenna output terminals; otherwise, the tests shall be made with the antenna connected and, if adjustable, fully extended. When measuring the ac conducted emissions from a device that operates between 150 kHz and 30 MHz a non-detachable antenna may be replaced with a dummy load for the measurements within the fundamental emission band of the transmitter, but only for those measurements.

Record the six highest EUT emissions relative to the limit of each of the current-carrying conductors of the power cords of the equipment that comprises the EUT over the frequency range specified by the procuring or regulatory agency. Diagram or photograph the test setup that was used. See Clause 8 for full reporting requirements.

Section 6.2.5: Measurement requirements

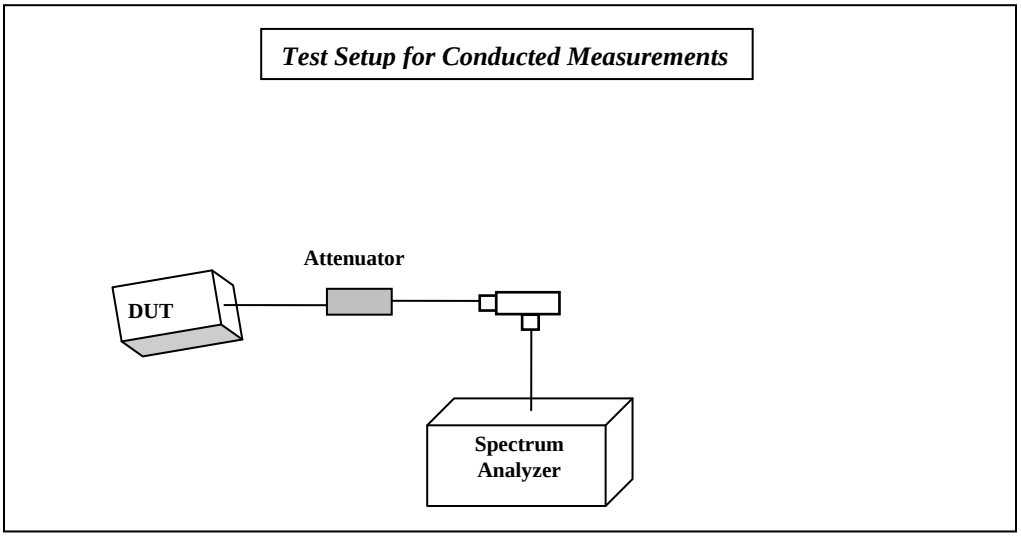
The LISN housing, measuring instrument case, reference ground plane, vertical conducting plane, if used, shall be bonded together.

Measured levels of ac power-line conducted emission shall be the emission voltages from the voltage probe or across the 50 Ω LISN port (to which the EUT is connected), where permitted, terminated into a 50 Ω measuring instrument, or where permitted or required, the emission currents on the power line sensed by a current probe. All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer, and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer. For those measurements, using a LISN, the 50 Ω measuring port is terminated by a measuring instrument having a 50 Ω input impedance. All other ports are terminated in 50 Ω loads.

Measurement Uncertainty: ±3.0dB

6.3 RF Conducted Measurement Procedure

Measurement according to FCC KDB 558074 D0:2013 (DTS Measurement Guidance)



1. Connect the equipment as shown in the above diagram.
2. Adjust the settings by entering test commands for TX/RX mode on/off, changing channels, modulations and data rates.
3. Measurements are to be performed with the EUT set to the low, middle and high channels.

Measurement Uncertainty: ±3.0dB

7 Maximum Peak Conducted Output Power and EIRP

7.1 Limits:

Maximum Peak Output Power:
FCC §15.247 (b)(1): 1W
IC RSS-210 issue 8, annex 8.4(2): 1W
EIRP:
IC RSS-210 issue 8, annex 8.4(2): 4W
(RSS-GEN: Antenna is only added to conducted value if it is >10dBm)

7.2 Test Conditions:

Tnom: 21°C; Vnom: 3.8V

7.3 Test Procedure

Measurement according to FCC KDB 558074 D01 v03r01 section 9.1.1

Peak Conducted Output Power
RBW ≥ DTS bandwidth of the emission being measured
VBW ≥ 3x RBW
Span ≥ 3 x RBW
Sweep = auto
Detector function = peak
Trace = max hold
Use the marker-peak function to set the marker to the peak of the emission.

7.4 Test Data

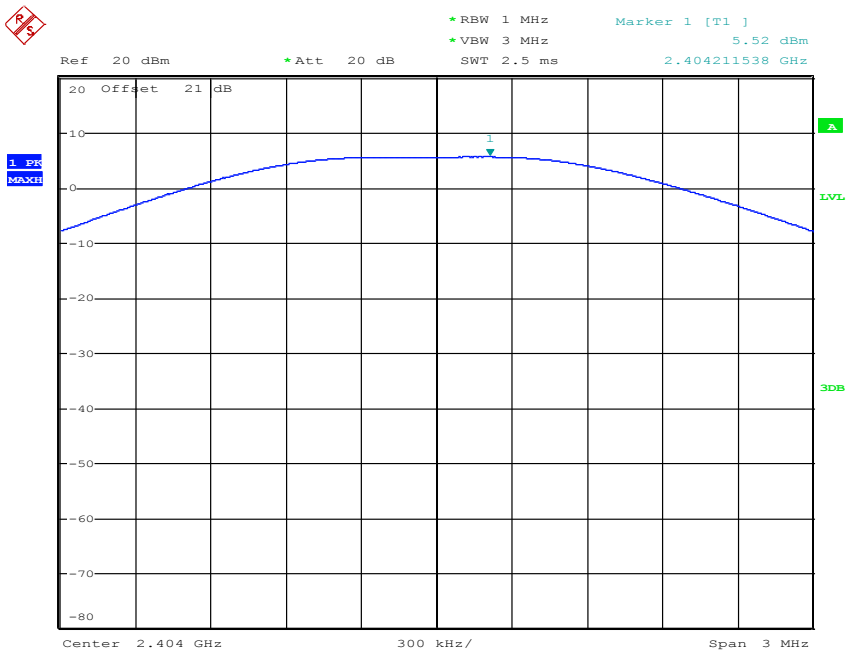
Maximum Peak Conducted Output Power (dBm)			
Mode	**Frequency (MHz)**		
	2404 Channel 0	**2442 Channel 18**	**2480 Channel 39**
802.15 (BTLE)	5.52	7.81	7.32

Declared Antenna Gain in the 2.4GHz band: -5.5 dBi

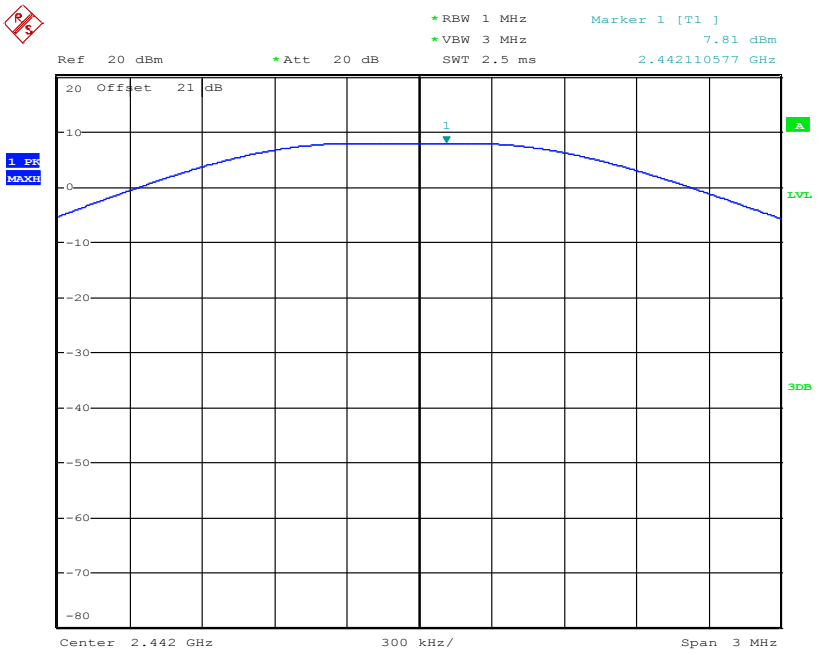
7.5 Measurement Result

Pass.

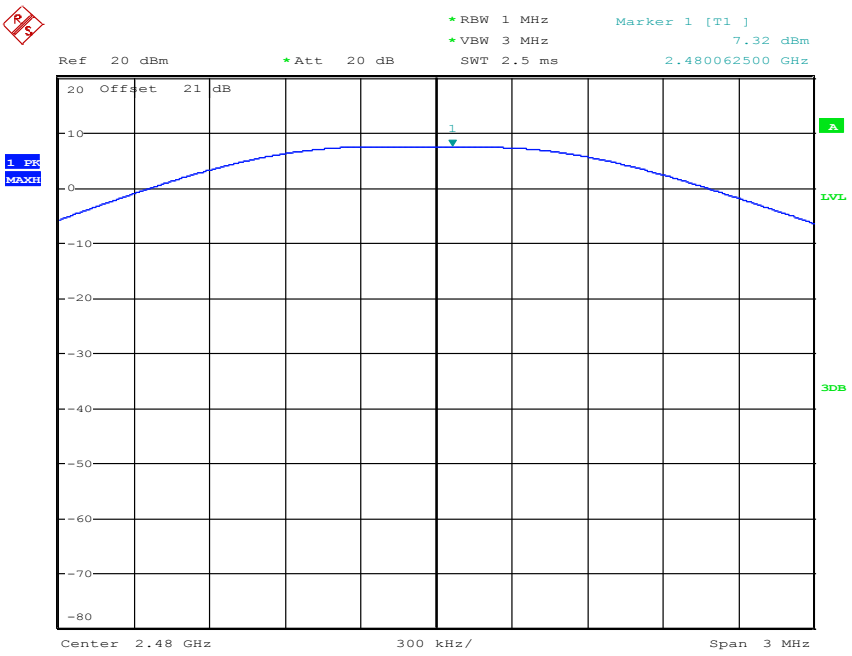
7.5.1 Conducted Peak Power -Ch Low (2404 MHz)- GFSK (BTLE)



7.5.2 Conducted Peak Power –Ch Mid (2442 MHz)- GFSK (BTLE)



7.5.3 Conducted Peak Power –Ch High (2480 MHz)- GFSK (BTLE)



8 Band Edge Compliance – at restricted and non-restricted band edges

8.1 Limits:

§15.209/15.205/15.247 (d) & RSS-Gen 7.2.2/ 7.2.5, RSS-210 8.5

Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

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 § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a).

8.2 Test Conditions:

Tnom: 21°C; Vnom: 3.8V

8.3 Measurement Procedure:

Measurement according to FCC KDB 558074 D01 v01r03 section 11/12.2

For Band Edge measurement
Peak measurements are made using a peak detector and RBW=100 KHz.
Average measurements performed using a peak detector and according to video averaging procedure with RBW=100 KHz and VBW=10Hz.
*PEAK LIMIT= 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.
*AVG. LIMIT= 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

For Restricted Band measurement
Peak measurements are made using a peak detector and RBW=100 KHz.
Average measurements performed using a peak detector and according to video averaging procedure with RBW=100 KHz and VBW=10Hz.

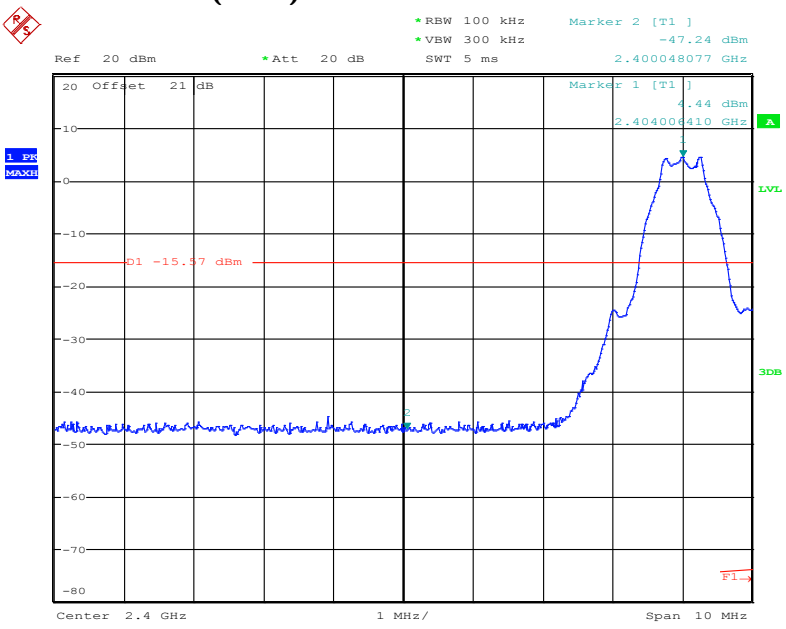
*PEAK LIMIT= 74dBµV/m (-21.2 dBm, for 3m)
*AVG. LIMIT = 54dBµV/m (-41.2 dBm, for 3m)

8.4 Measurement Result

Pass.

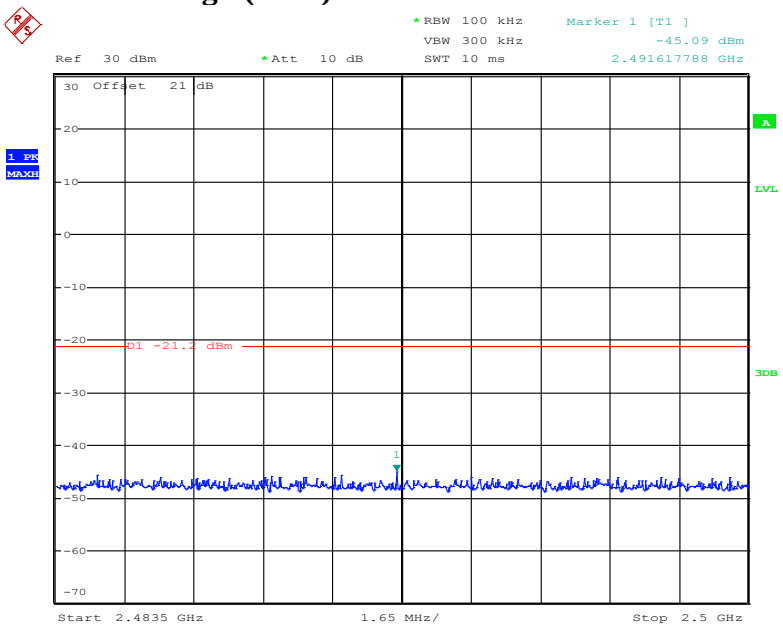
8.4.1 Test Data/plots: 2.4 GHz Band

Lower band edge –Ch Low- BTLE (Peak)

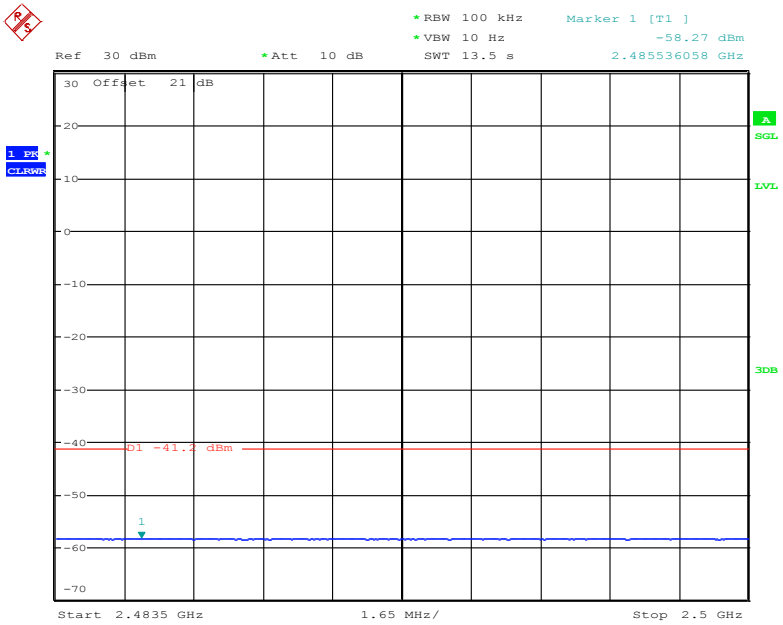


Restricted Band (Conducted)

Upper restricted band – Ch High (Peak)



Upper restricted band – Ch High (Average)



9 Occupied Bandwidth (6dB and 99% Bandwidth)

9.1 Limits:

9.1.1.1 §15.247 (a)(2)

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

9.2 Test Conditions:

Tnom: 22 ºC; Vnom: 3.8V

9.3 Test Procedure

Measurement according to FCC KDB 558074 D01 v01r03 section 8.1

For 6 dB bandwidth:

Spectrum Analyzer settings:

Span= Wide enough to capture the entire emission bandwidth
RBW= 100 KHz
VBW≥ 3xRBW
Detector: Peak-
Sweep Time: Auto
Trace = Max Hold

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the peak level measured in the fundamental emission.

For 99% bandwidth:

Use the occupied bandwidth in the measurement function of the spectrum analyzer with power bandwidth setting at 99%

9.4 Test Data Results:

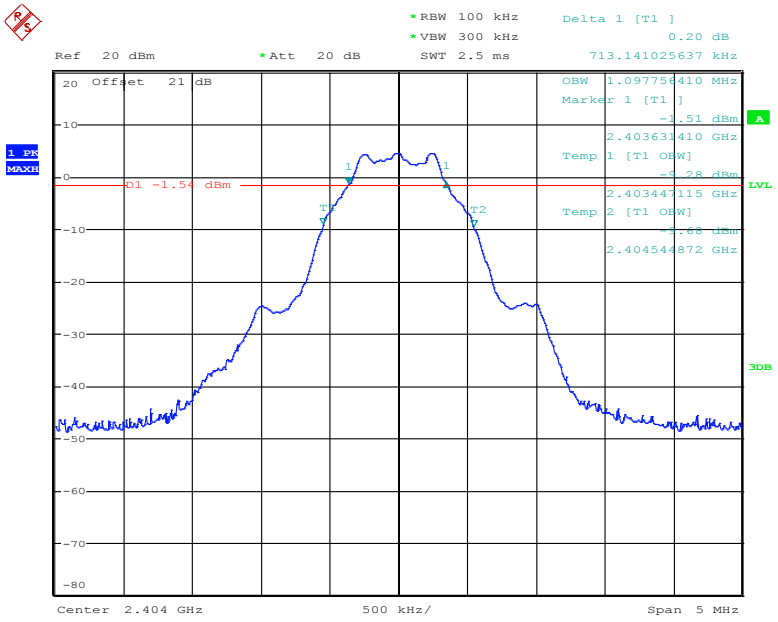
2.4 GHz Band

Occupied Bandwidth (MHz)						
Mode	**Frequency (MHz)**					
	2404 Channel 0		**2442 Channel 18**		**2480 Channel 39**	
	6dB (KHz)	**99% (GHz)**	**6dB (KHz)**	**99% (GHz)**	**6dB (KHz)**	**99% (GHz)**
802.15 LE	713.14	1.097	713.14	1.089	679.11	1.098

9.5 Measurement Result

Pass.

9.5.1 6dB & 99% Bandwidth 802.15 -Ch Low -2404 MHz



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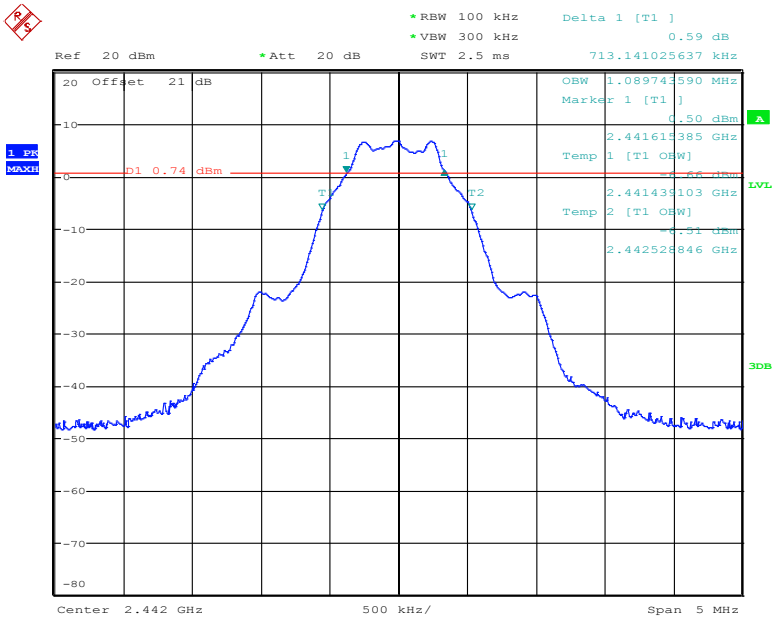
9.5.2 6dB & 99% Bandwidth 802.15 -Ch Mid -2442 MHz



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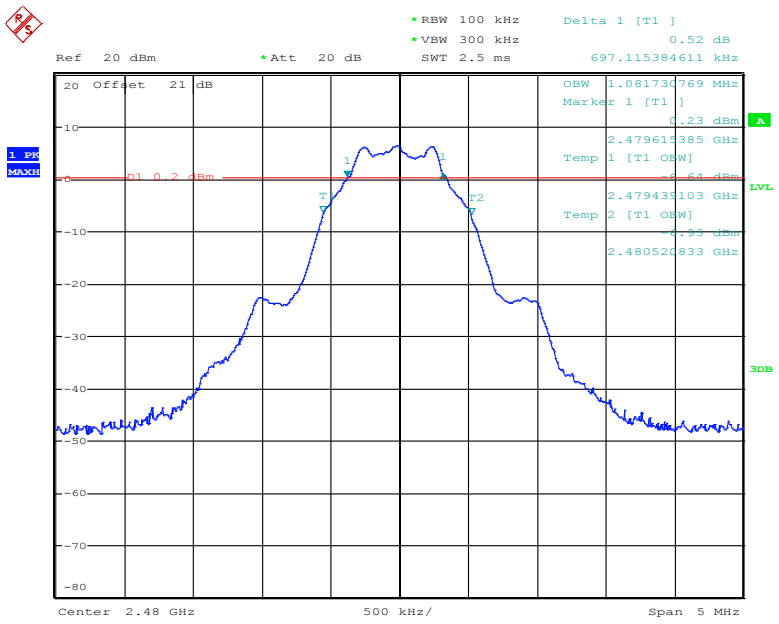
9.5.3 6dB & 99% Bandwidth 802.15 -Ch High -2480 MHz



Date: 28.FEB.2014 22:48:43

10 Power Spectral Density

10.1 Limits:

§ 15.247 (e) & RSS-210 A8.2 (b)

For digitally modulated systems, the peak 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.

10.2 Test Conditions:

Tnom: 21°C; Vnom: 3.8V

10.3 Measurement procedure

Measurement according to FCC KDB 558074 D01 V03R01 section 10.2

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 x the DTS BW
3. Set the RBW=3 kHz, VBW ≥ 3 x RBW and sweep time = auto.
4. Trace mode = max hold
5. Detector = Peak
6. Allow trace to fully stabilize and use peak marker function to determine the highest level as the PSD.

10.4 Test Data Results: 2.4

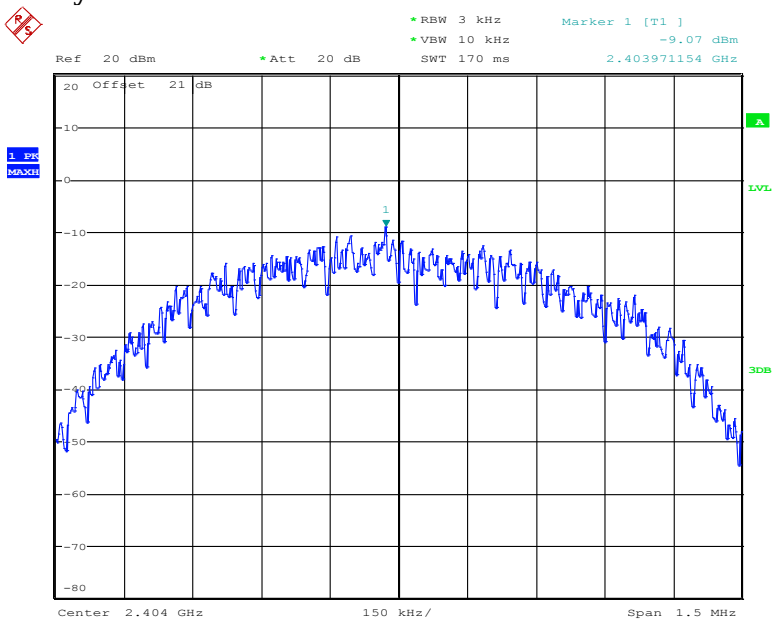
Power Spectral Density (dBm)			
Mode	**Frequency (MHz)**		
	2404 Channel 0	**2442 Channel 18**	**2480 Channel 39**
802.15 (BTLE)	-9.07	-6.74	-7.21

10.4.1 Measurement Result

Pass.

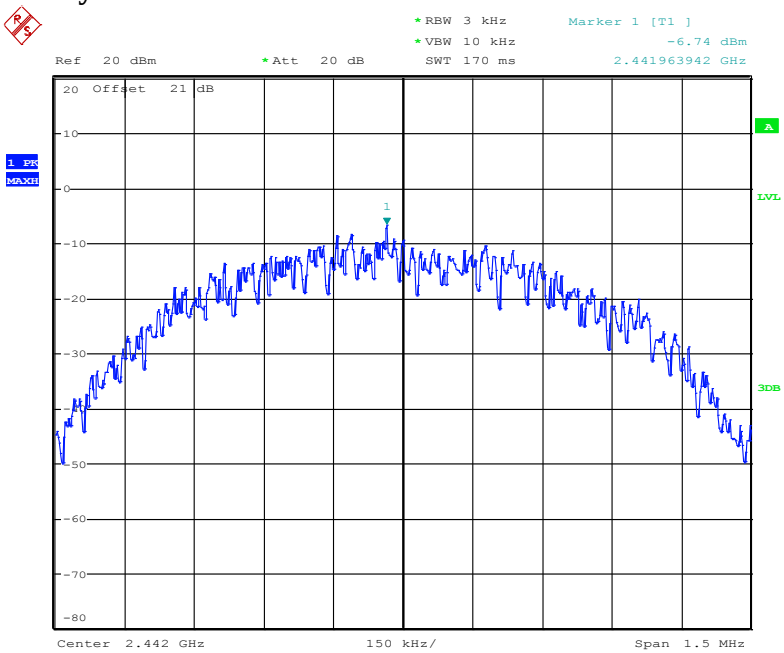
10.5 Measurement Plots:

Power Spectral Density GFSK -Ch Low -2404 MHz



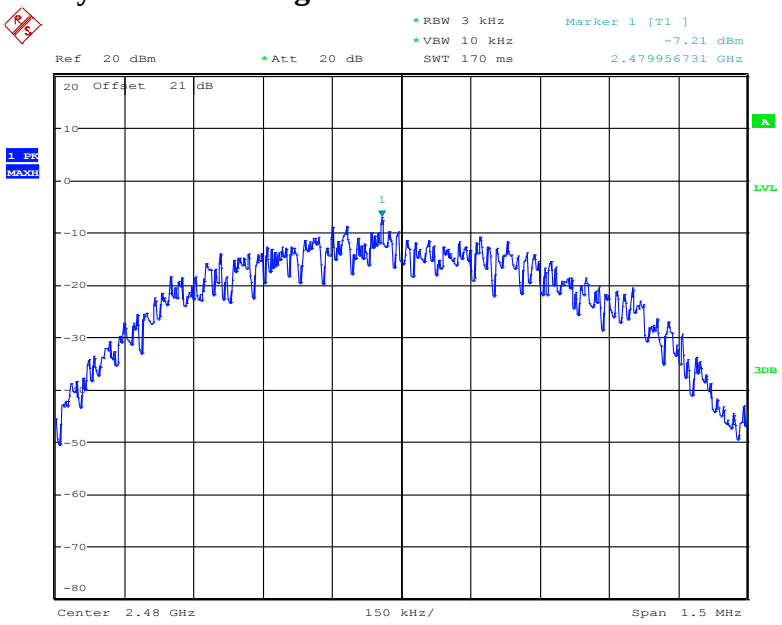
Date: 28.FEB.2014 23:13:10

Power Spectral Density GFSK –Ch Mid -2442 MHz



Date: 28.FEB.2014 23:14:40

Power Spectral Density GFSK –Ch High -2480 MHz



Date: 28.FEB.2014 23:06:35

11 Radiated Transmitter Spurious Emissions - Restricted Band Limits

11.1 Limits:

§15.209/15.205/15.247 & RSS-Gen 7.2.2/ 7.2.5, RSS-210 A8.5

Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

Table 1:

Frequency of emission (MHz)	Field strength (µV/m)
30–88	100 (40dBµV/m)
88–216	150 (43.5 dBµV/m)
216–960	200 (46 dBµV/m)
Above 960	500 (54 dBµV/m)

Table 2:

Frequency of emission (MHz)	Field strength (µV/m)	Measurement Distance (m)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30

11.2 Test Conditions:

Tnom: 23 °C; Vnom: 3.8V
Test mode: *Modulation:* GFSK

11.3 Measurement procedure:

Measurement according to ANSI C63.10:2009 (also refer to section 6.1 in this test report)

11.4 Test Result:

Plots reported here represent the worst case emissions for horizontal and vertical antenna polarizations and for three orientations of the EUT.

11.4.1 Measurement Result

Pass.

11.4.2 Test Data Result:

Mode: GFSK
Data Rate: 1 mbps
Channel: Low
Frequency range: 30 MHz – 1 GHz

Frequency (MHz)	Peak (dBuV/m)	Quasi-Peak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Antenna Polarity	Azimuth (deg)	Corr. (dB)	Limit (dBµV/m)	Margin (dB)
143.99	----	30.97	120	100	V	68	9.3	43.5	12.6
213.98	-----	26.2	120	100	V	0.0	12.1	43.5	17.4
215.56	-----	32.4	120	100	V	180	12.2	43.5	11.1
274.59	-----	30.0	120	100	V	112.0	14.8	46	28.7

Modulation: GFSK
Data Rate: 1 mbps
Channel: Mid
Frequency range: 30 MHz – 1 GHz

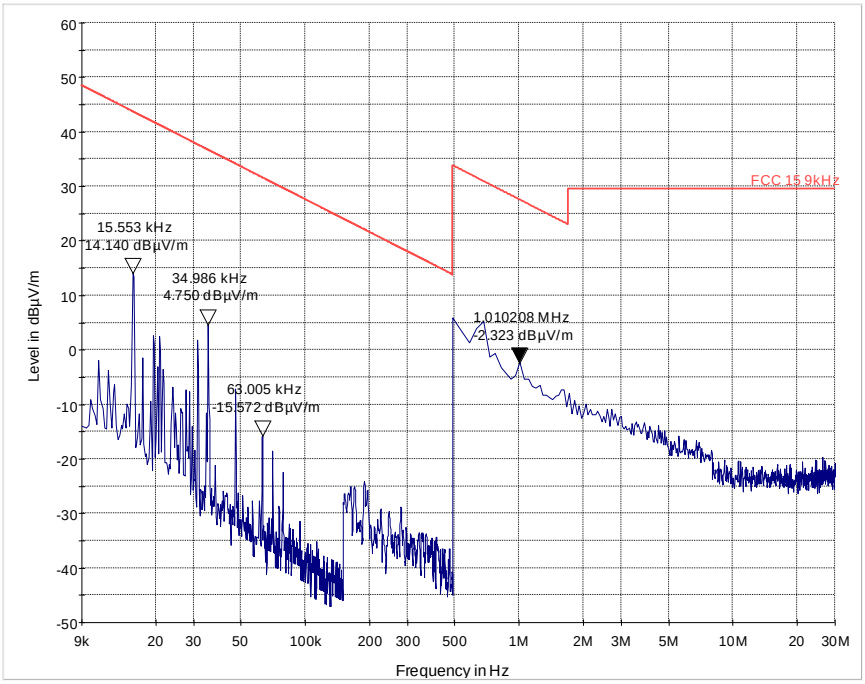
Frequency (MHz)	Peak (dBuV/m)	Quasi-Peak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Antenna Polarity	Azimuth (deg)	Corr. (dB)	Limit (dBµV/m)	Margin (dB)
143.99	-----	31.6	120	100	V	112	9.3	43.5	11.9
160.76	-----	24.2	120	99.0	V	158	13.2	43.5	19.4
213.98	-----	28.0	120	100	V	0.0	12.1	43.5	15.5
215.28	-----	32.1	120	100	V	202	12.1	43.5	11.4

Modulation: 802.11n
Data Rate: 6 mbps
Channel: High
Frequency range: 30 MHz – 1 GHz

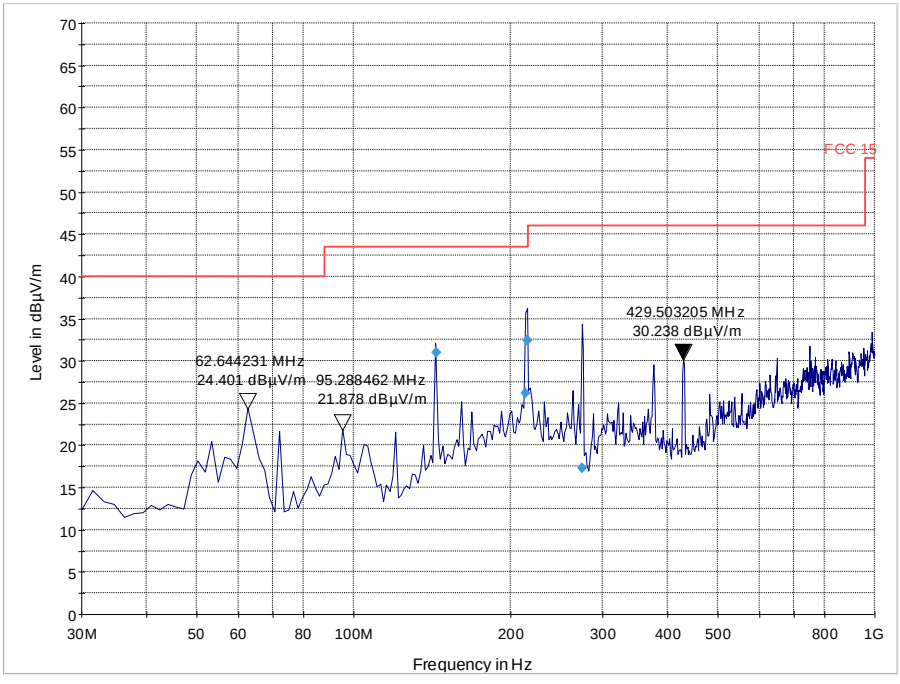
Frequency (MHz)	Peak (dBuV/m)	Quasi-Peak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Antenna Polarity	Azimuth (deg)	Corr. (dB)	Limit (dBµV/m)	Margin (dB)
32.54	----	12.2	120	99.0	V	22	6.8	40	27.8
212.91	----	26.2	120	123	V	75	12.0	43.5	17.3
215.53	----	23.729	120	100	V	159	12.1	43.5	19.8
232.68	----	28.0	120	100	V	179	13.5	46	18.0
273.82	----	21.4	120	100	V	202	14.7	46	24.6
431.37	----	30.7	120	100	H	192	18.4	46	15.3
856.91	----	25.5	120	100	V	166	25.8	46	20.5
905.25	-----	27.4	120	100	H	292	27.5	46	18.6

11.4.3 Measurement Plots:

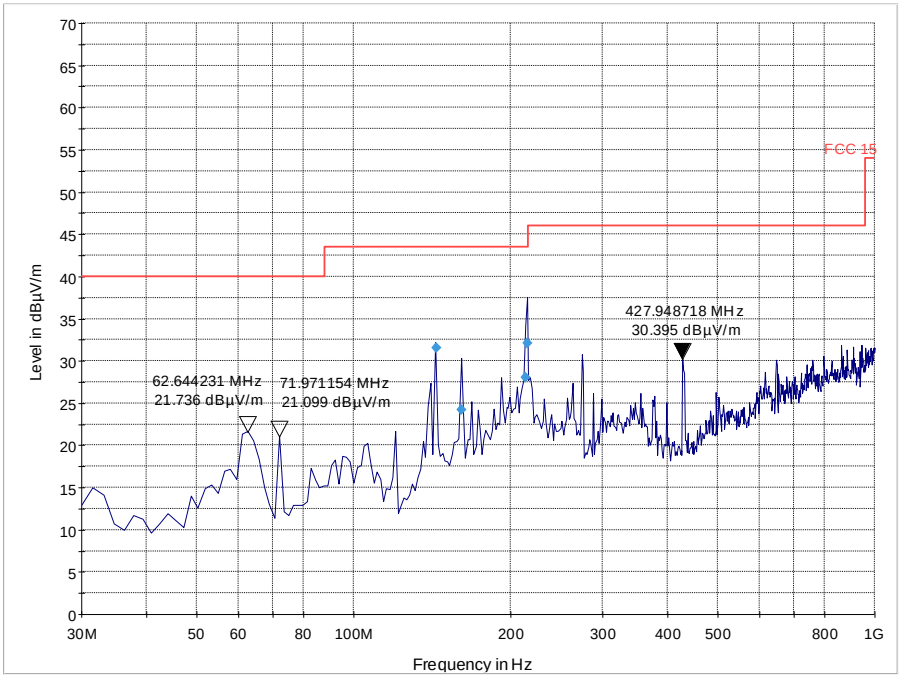
Transmitter Radiated Spurious Emission: Ch Mid- 9kHz – 30MHz- GFSK



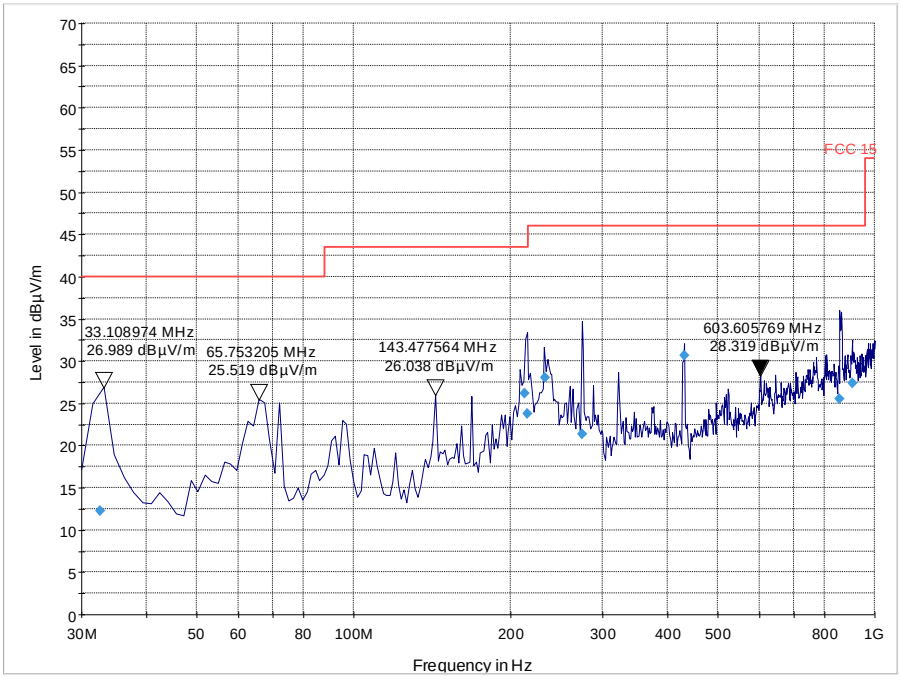
Transmitter Radiated Spurious Emission: Ch Low- 30 MHz – 1GHz- GFSK



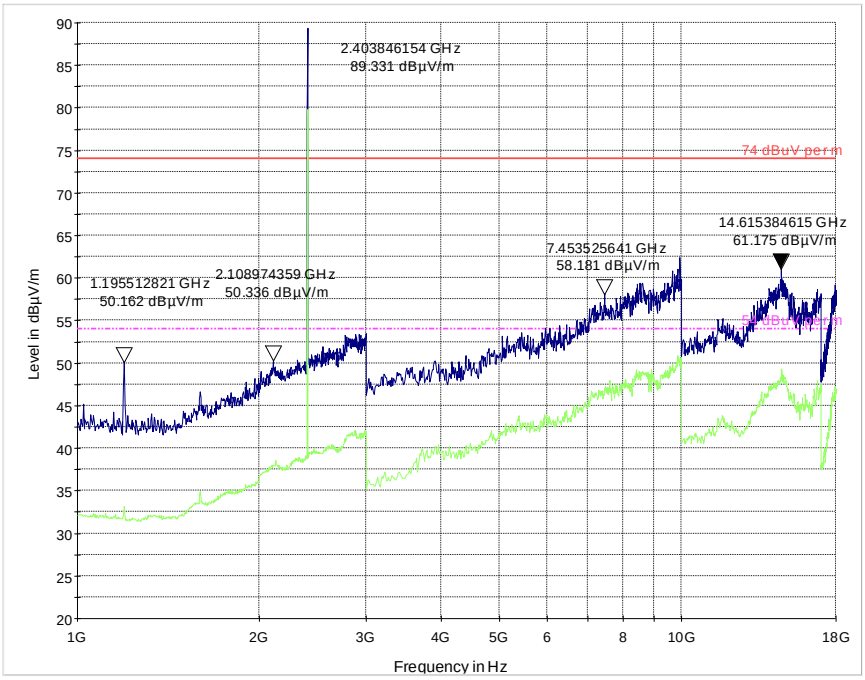
Transmitter Radiated Spurious Emission: Ch Mid- 30 MHz – 1GHz- GFSK



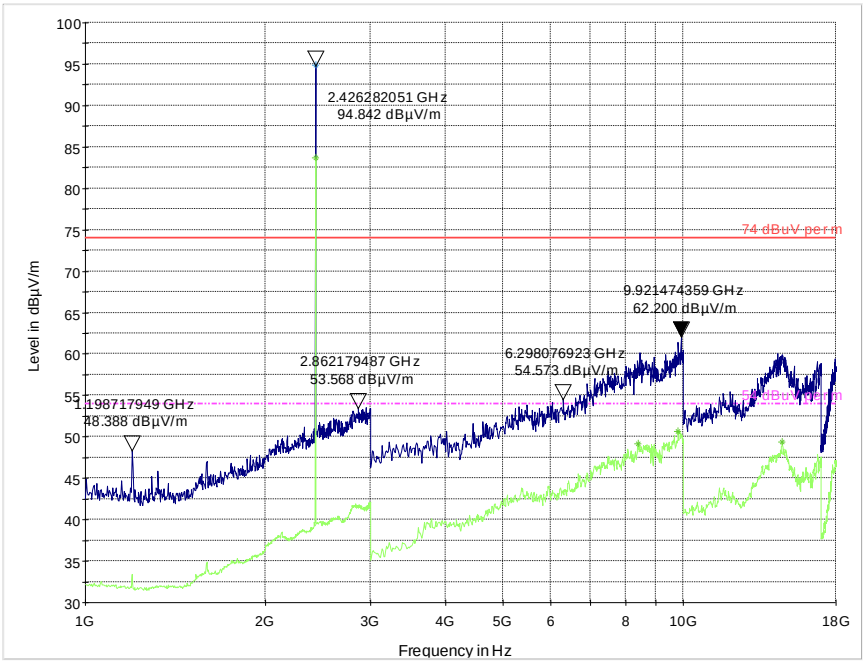
Transmitter Radiated Spurious Emission: Ch High- 30 MHz – 1GHz- GFSK



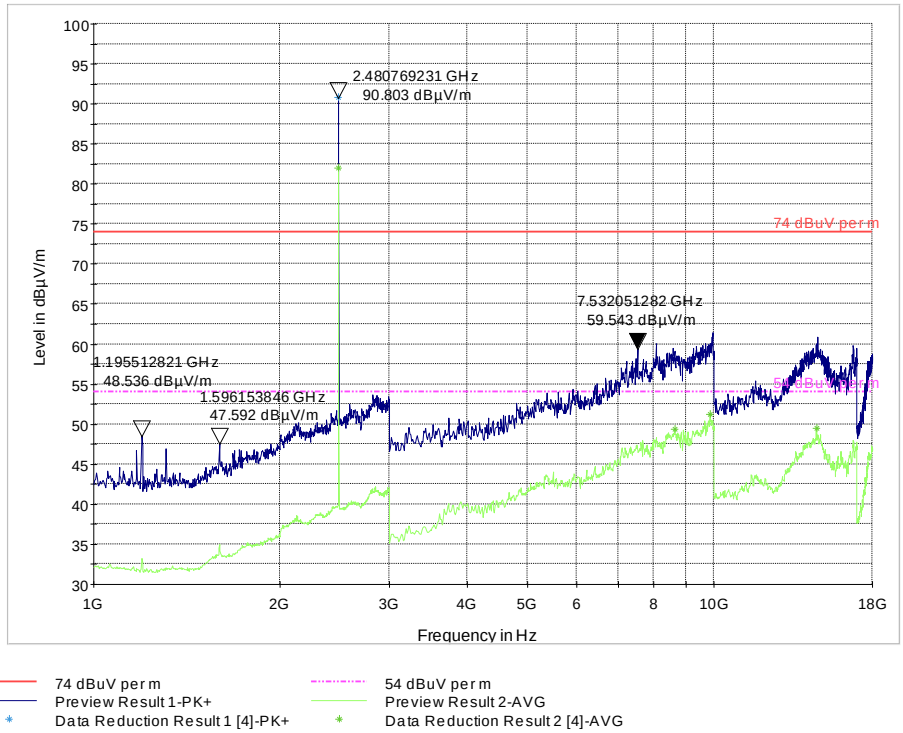
Transmitter Radiated Spurious Emission: Ch Low- 1 GHz – 18GHz- GFSK



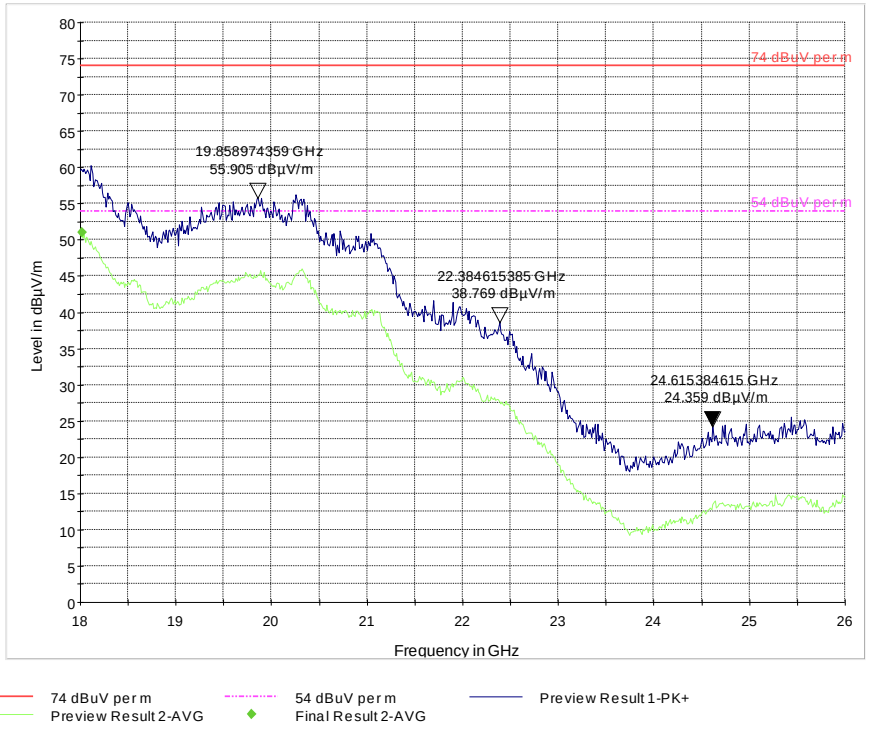
Transmitter Radiated Spurious Emission: Ch Mid- 1 GHz – 18GHz- GFSK



Transmitter Radiated Spurious Emission: Ch High- 1 GHz – 18GHz- GFSK



Transmitter Radiated Spurious Emission: Ch Mid- 18 GHz – 26 GHz- GFSK



12 AC Power Line Conducted Emissions

12.1 References:

FCC: CFR Part 15.207
The purpose of this test is to measure unwanted radio frequency currents induced in any AC conductor external to the equipment which could conduct interference to other equipment via the AC electrical network.

12.2 Limits:

§15.207 & RSS-Gen 7.2.4

(a) Except as shown in paragraphs (b) and (c) of this section of the CFR, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table (1), as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Table 1:

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

12.3 Test Conditions:

Tnom: 23 °C; Vnom: 3.8V

Receive and transmit mode of operation of operation

12.4 Measurement procedure:

Measurement according to ANSI C63.10:2009 section 6.2 (also refer to section 6, 6.2 in this test report)
Analyzer Settings:
CISPR Bandwidth- 9KHz.
Detector = Qusi-peak / Average

12.5 Results

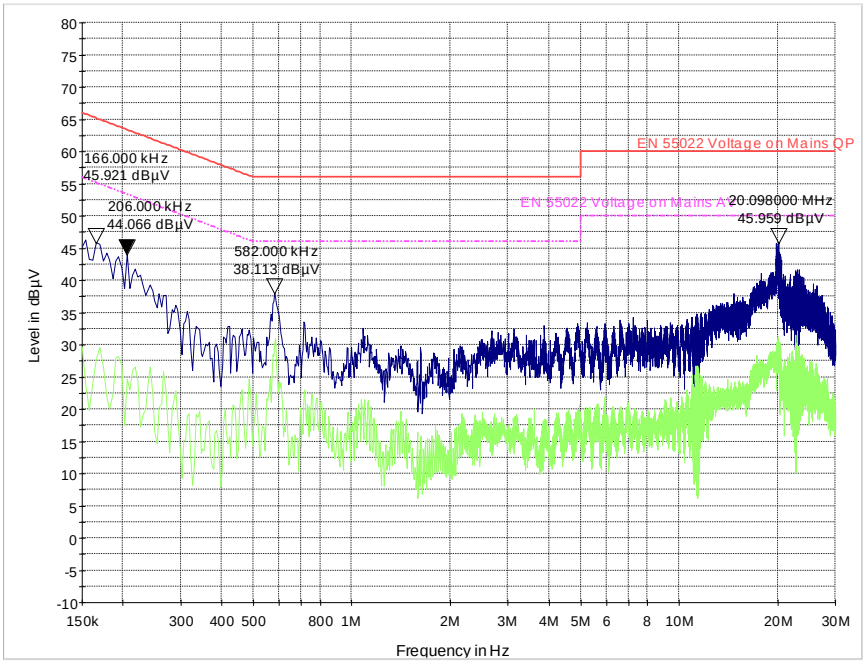
Plots shown here represent the combined worse case emissions for power lines, phases and neutral line.

12.5.1 Measurement Result

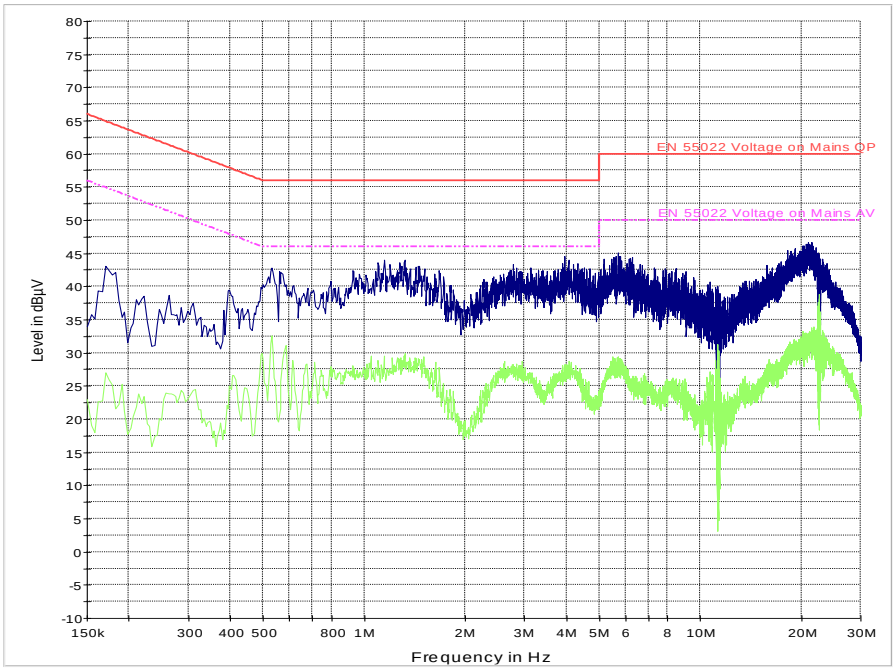
Pass.

12.5.2 Test Data/ Plots

Conducted Emissions: 150 KHz – 30 MHz
TX Mode (GFSK):



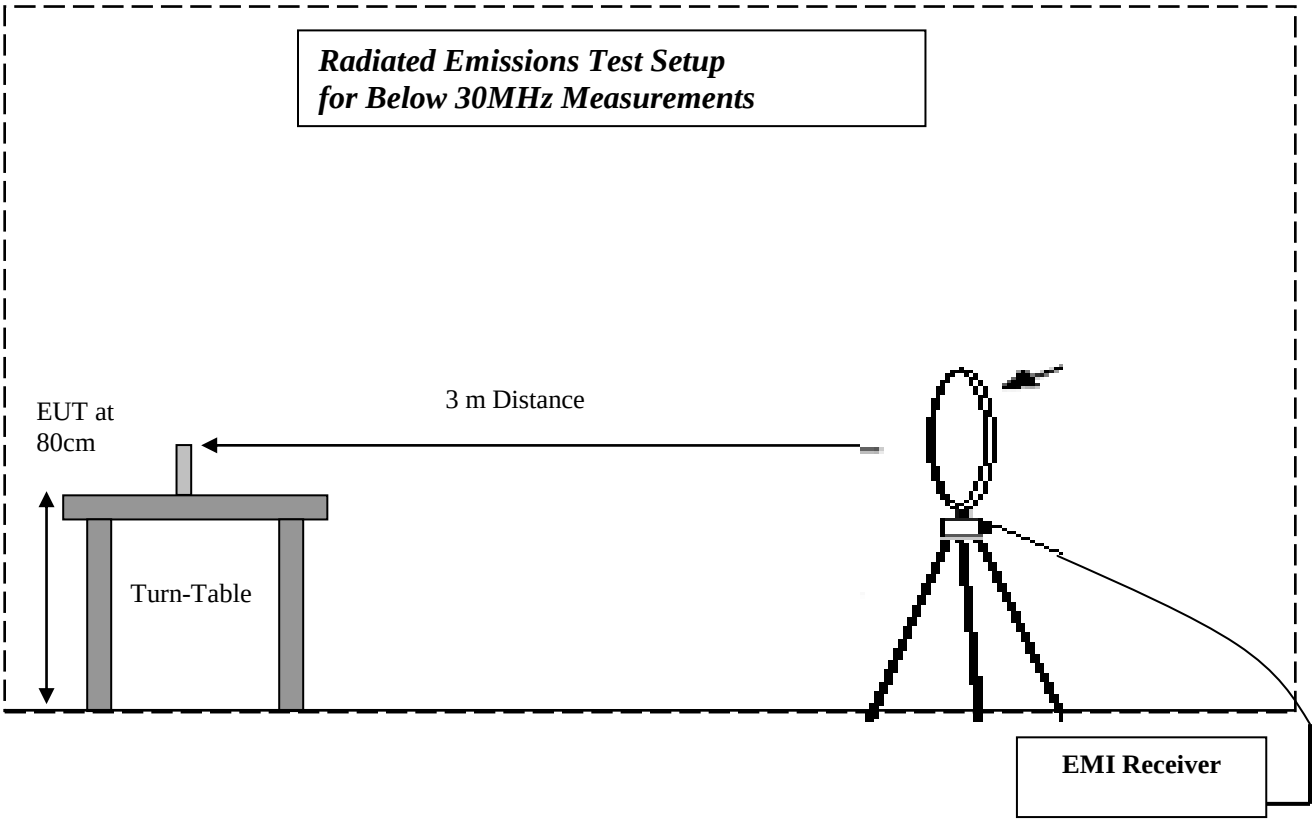
RX/Idle mode:

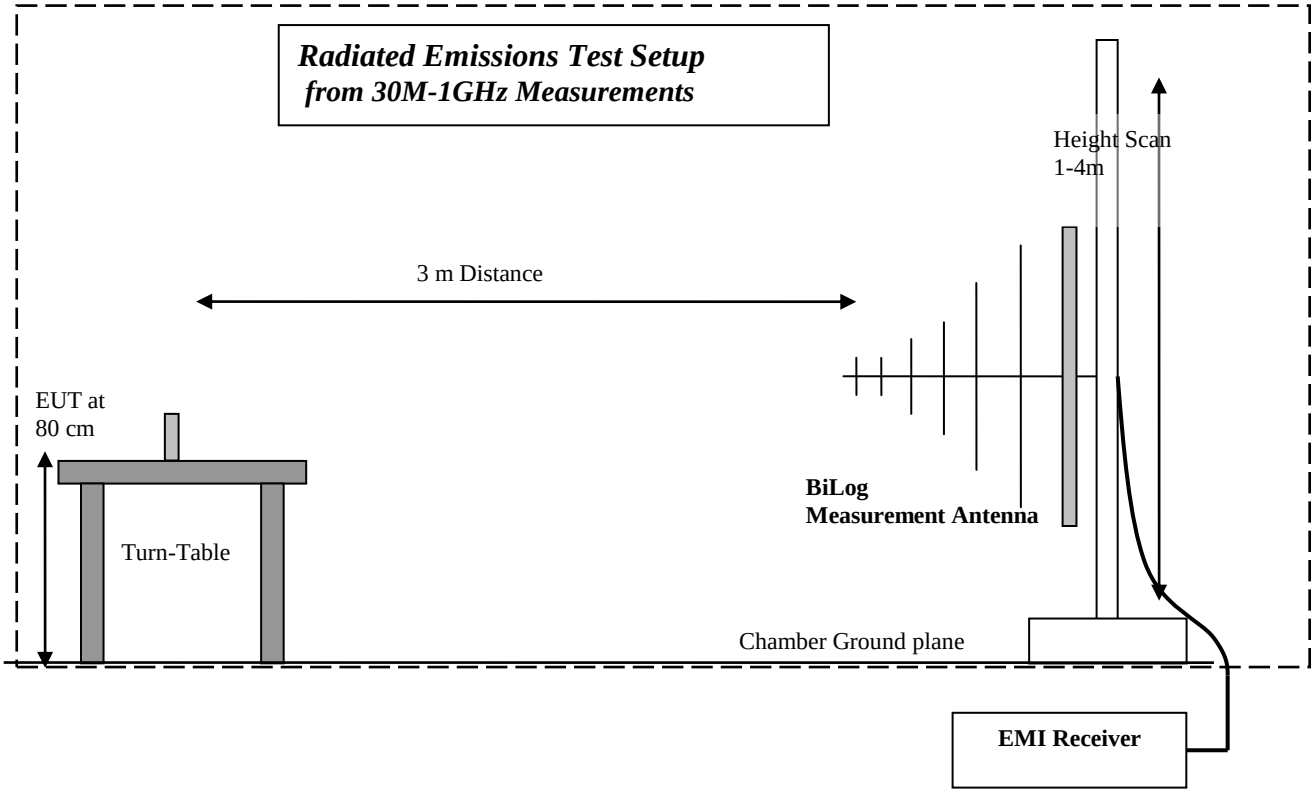

EN 55022 Voltage on Mains QP
EN 55022 Voltage on Mains AV
Level in dBµV
Frequency in Hz
150k
300
400
500
800
1M
2M
3M
4M
5M
6
8
10M
20M
30M
EN 55022 Voltage on Mains QP
Preview Result 1-PK+
EN 55022 Voltage on Mains AV
Preview Result 2-AVG

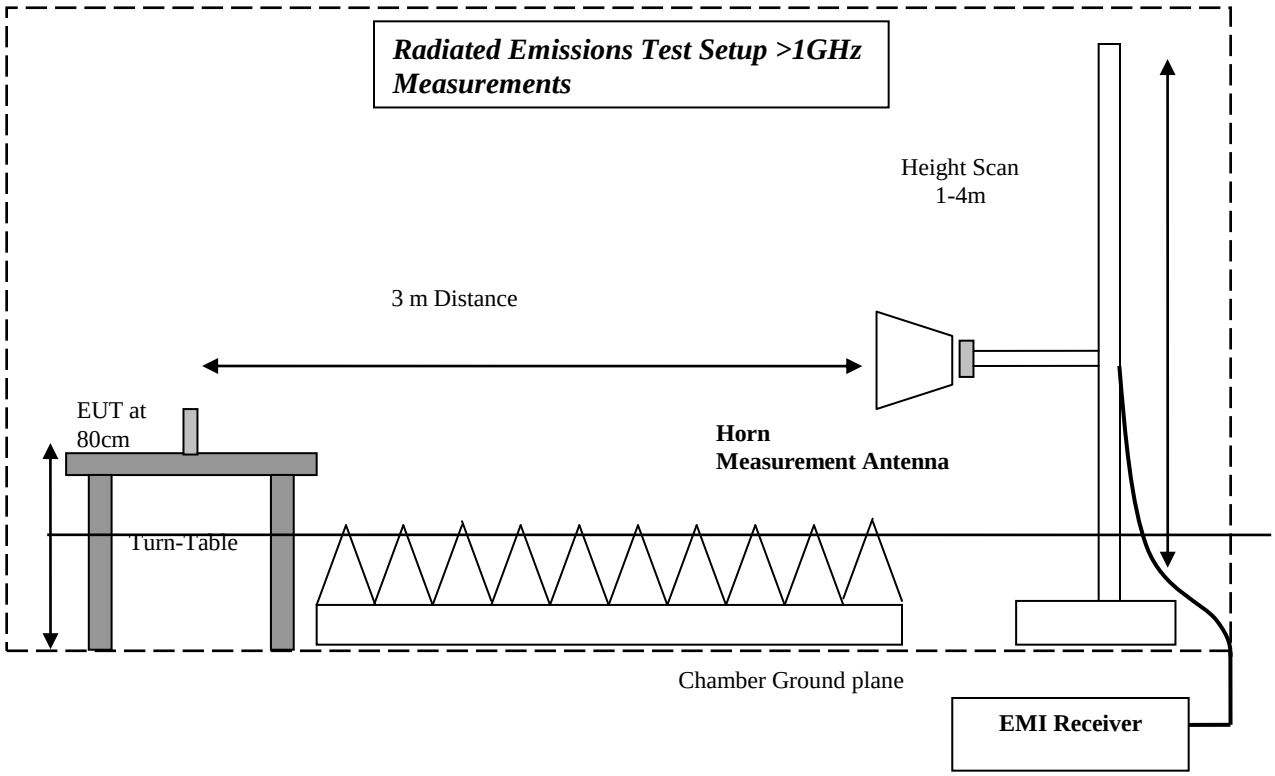
13 Test Equipment and Ancillaries used for tests

Instrument/Ancillary	Model	Manufacturer	Serial No.	Cal Date	Cal Interval
EMI Receiver/Analyzer	ESU 40	Rohde & Schwarz	100251	Sept 2013	2 Years
Spectrum Analyzer	FSU	Rohde & Schwarz	200302	Jun 2013	2 Years
Pre-Amplifier	Miteq	JS40010260	340125	N/A	N/A
Binconilog Antenna	EMCO	3141	0005-1186	Apr 2012	3 Years
Binconilog Antenna	ETS	3149	J000123908	Feb 2012	3 years
Horn Antenna	EMCO	3115	35114	Mar 2012	3 Years
Loop Antenna	EMCO	6512	00049838	Apr 2012	3 years
Communication Antenna	IBP5-900/1940	Kathrein	n/a	n/a	n/a
High Pass Filter	5HC2700	Trilithic Inc.	9926013	Part of system calibration	
High Pass Filter	4HC1600	Trilithic Inc.	9922307	Part of system calibration	
6GHz High Pass Filter	HPM50106	Microtronics	001	Part of system calibration	
Pre-Amplifier	JS4-00102600	Miteq	00616	Part of system calibration	
LISN	R&S	ESH3-Z5	836679/003	Jun 2013	3 Years
Spectrum Analyzer	Rohde&Schwarz	FSU	200302	Jun 2013	2 Years
Power Splitter	Agilent	11667B	52565	N/A	N/A

14 Block Diagrams






Radiated Emissions Test Setup >1GHz Measurements
Height Scan 1-4m
3 m Distance
EUT at 80cm
Horn Measurement Antenna
Turn-Table
Chamber Ground plane
EMI Receiver

15 Revision History

Date	Report Name	Changes to the report	Report prepared by
2014-06-11	**EMC_INTEL_039_14001_15.247_BTLE**	**First Revision**	**Danh Le**