CERTIFICATE #3478.01

TEST REPORT

EUT Description	**WiGig, 2x2 PCIe M.2 adapter card**
Brand Name	**Intel® Wireless Gigabit 11100**
Model Name	**11100D2W**
FCC/IC ID	**FCC ID: PD911100D2/IC ID: 1000M-11100D2**
Date of Test Start/End	**2018-01-15/ 2018-02-19**
Features	**802.11 ad Wireless LAN** (see section 5)

Applicant	**Intel Mobile Communications**
Address	**100 Center Point Circle, Suite 200** **Columbia, South Carolina 29210** **USA**
Contact Person	**Steven Hackett**
Telephone/Fax/ Email	**steven.c.hackett@intel.com**

Reference Standards	**FCC CFR Title 47 Part 15C, Part 2.1091** **IC RSS-210 Issue 9, IC RSS-Gen Issue 4, IC RSS-102 Issue 5** (see section 1)

Test Report identification	**180209-01.TR08**
Revision Control	**Rev. 00** **This test report revision replaces any previous test report revision** (see section 8)

The test results relate only to the samples tested.
The test report shall not be reproduced in full, without written approval of the laboratory.

Issued by

Digitally signed by Walid EL HAJJ
Date: 2018.03.07 19:42:54 +01'00'

Walid EL HAJJ
(Test Engineer Lead)

Reviewed by

Digitally signed by Jose M. FORTES
DN: cn=Jose M. FORTES, o=Intel Mobile Communications, ou=WRF Lab, email=jose.m.fortes.lopez@intel.com, c=FR
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Jose M. FORTES
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Table of Contents

1. Standards, reference documents and applicable test methods

1. FCC 47 CFR Part 15 - Subpart C – §15.255 Operation within the band 57-64 GHz.
2. ANSI C63.10-2013, Clause 9 – Procedures for testing millimeter-wave systems.
3. IC RSS-Gen Issue 4 – General Requirements for Compliance of Radio Apparatus.
4. IC RSS-210 Issue 8 – Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment.
5. FCC 47 CFR Part 2 – Subpart J – §2.1091 Radiofrequency radiation exposure evaluation: mobile devices.
6. IC RSS-102 Issue 5 – Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands).

2. General conditions, competences and guarantees

- ✓ Intel Mobile Communications France SAS Wireless RF Lab (Intel WRF Lab) is an ISO/IEC 17025:2005 testing laboratory accredited by the American Association for Laboratory Accreditation (A2LA) with the certificate number 3478.01.
- ✓ Intel Mobile Communications France SAS Wireless RF Lab (Intel WRF Lab) is an Accredited Test Firm recognized by the FCC, with Designation Number FR0011.
- ✓ Intel Mobile Communications France SAS Wireless RF Lab (Intel WRF Lab) is a Registered Test Site listed by IC, with IC Assigned Code 1000Y.
- ✓ Intel WRF Lab only provides testing services and is committed to providing reliable, unbiased test results and interpretations.
- ✓ Intel WRF Lab is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.
- ✓ Intel WRF Lab has developed calibration and proficiency programs for its measurement equipment to ensure correlated and reliable results to its customers.
- ✓ This report is only referred to the item that has undergone the test.
- ✓ This report does not imply an approval of the product by the Certification Bodies or competent Authorities.

3. Environmental Conditions

- ✓ At the site where the measurements were performed the following limits were not exceeded during the tests:

Temperature	21ºC ± 4ºC
Humidity	40% ± 13%

4. Test samples

Sample	Control #	Description	Model	Serial #	Date of reception	Note
#01	170801-01-S08	RF Module	11000D2W	ICN : PnP-Cfg20.2 TA : J64013-001	9/05/2017	Used for spurious emissions tests from 30 MHz to 40 GHz
	15120401-S02	Extender board	TA : H82062-0	ASS00469-001 4694213-524	12/08/2015	
	15120401-S03	Socket Card	N/A	N/A	12/8/2015	
	170000-01.S02	Laptop	Latitude E5470	21HTPF2	3/28/2017	
	170801-01.S14	WiGig Antenna	RFEM 2	N/A	9/15/2017	
#02	170801-01-S08	RF Module	11000D2W	ICN : PnP-Cfg20.2 TA : J64013-001	9/05/2017	Used for all tests above 40 GHz, except for Power measurements for channels 1 and 2
	15120401-S02	Extender board	TA : H82062-0	ASS00469-001 4694213-524	12/08/2015	
	15120401-S03	Socket Card	N/A	N/A	12/8/2015	
	170801-01.S34	Laptop	Latitude E5470	FT6LMC2	2017-05-30	
	15032601.S42	WiGig Antenna	RFEM 2	N/A	11/16/2015	
#03	170801-01-S08	RF Module	11000D2W	ICN : PnP-Cfg20.2 TA : J64013-001	9/05/2017	Used for Power measurements for channels 1 and 2
	15120401-S02	Extender board	TA : H82062-0	ASS00469-001 4694213-524	12/08/2015	
	15120401-S03	Socket Card	N/A	N/A	12/8/2015	
	170801-01.S34	Laptop	Latitude E5470	FT6LMC2	2017-05-30	
	15032601.S47	WiGig Antenna	RFEM 2	N/A	11/16/2015	

5. EUT Features

Brand Name	Intel® Wireless Gigabit 11100
Model Name	11100D2W
FCC/IC ID	FCC ID: PD911100D2/IC ID: 1000M-11100D2
Software Version	OEM_DRTU_06794_10_182_0G OEM_DRTU_06871_10_184_0G (used only for Spurious Emission tests from 6.4 GHz to 18 GHz)
Driver Version	Driver version: V4.0.10263.42
Prototype / Production	Production
Supported Radios	802.11ad 60GHz (57.24 – 63.72 GHz)
Antenna Information	Intel ® Wireless Gigabit Antenna-M 10042R (Array Antenna Model No . 10042RRFW)
Additional Information	N/A

6. Remarks and comments

N/A

7. Test Verdicts summary

FCC Standard	RSS Standard	Test	Verdict
15.255 (e) (1)	RSS-210 Annex J.4	Emission & Occupied Bandwidth	P
15.255 (c) (1)(i)	RSS-210 Annex J.2.1.a	Peak and Average Power, RF detector	P
15.255 (e) (1)	RSS-210 Annex J.4	Peak Output Power, RF detector	P
15.255 (d) (1) (2) (3) (4)	RSS-210 Annex J.3	Spurious Emissions	P
15.255 (f)	RSS-210 Annex J.6	Frequency Stability	P
15.255 (h)	RSS-210 Annex J.7	Group Installation	P
15.255 (g) 2.1091	RSS-102 issue 5	RF Exposure	P

P: Pass
F: Fail
NM: Not Measured
NA: Not Applicable

8. Document Revision History

Revision #	Date	Modified by	Revision Details
Rev. 00	2018-03-07	G.Gerbaud I. Kharrat	First Issue

Annex A. Test & System Description

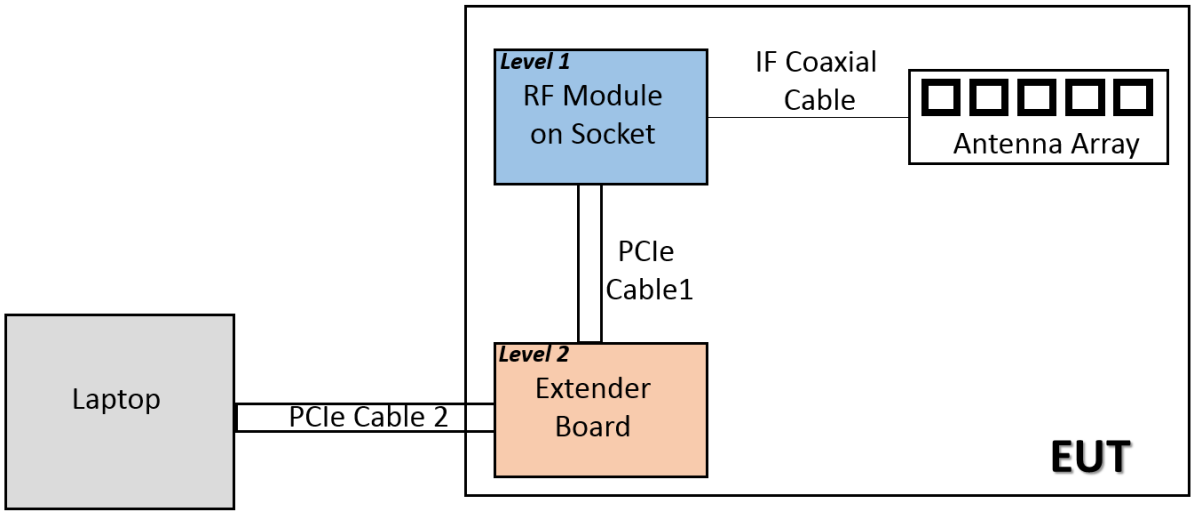
A.1 EUT Description

The EUT is a 60 GHz 802.11ad WiGig module adapter supporting one RFEM2 antenna arrays with typical application intended for VR applications (client side):

Operation Frequencies	
Channel 1	58.32 GHz
Channel 2	60.48 GHz
Channel 3	62.64 GHz

Peak Antenna Gain	Channel 1: 15.3	Channel 2: 15.2	Channel 3 : 14.8	dBi
Highest Peak EIRP	27.41			dBm
Highest Peak Output Power	18.24			mW

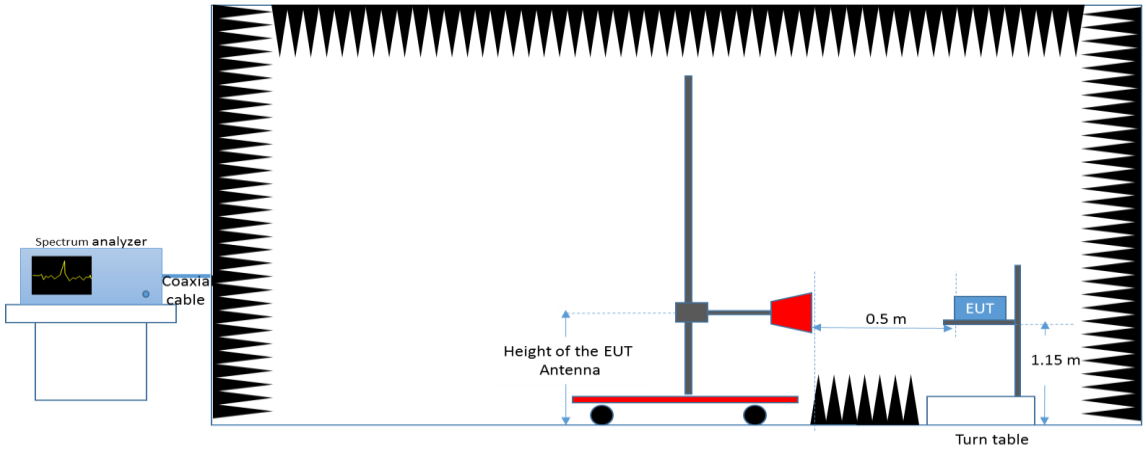
The EUT is built in two levels. In the first level the tested RF module is connected to an antenna array via an Intermediate Frequency (IF) coaxial cable and mounted on socket card. This socket card is connected to an extender board (second Level) via a PCIe cable. The group is connected to a laptop via a second PCIe cable.



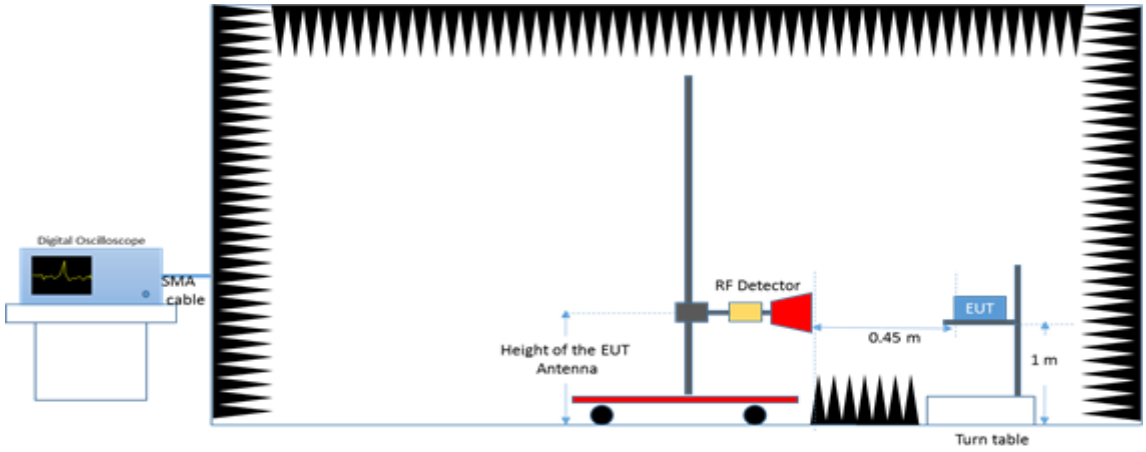
A.2 Measurement System

Measurements were performed using the following setups, made in accordance to the general provisions of ANSI C63.10-2013, Clause 9 – Procedures for testing millimeter-wave systems.

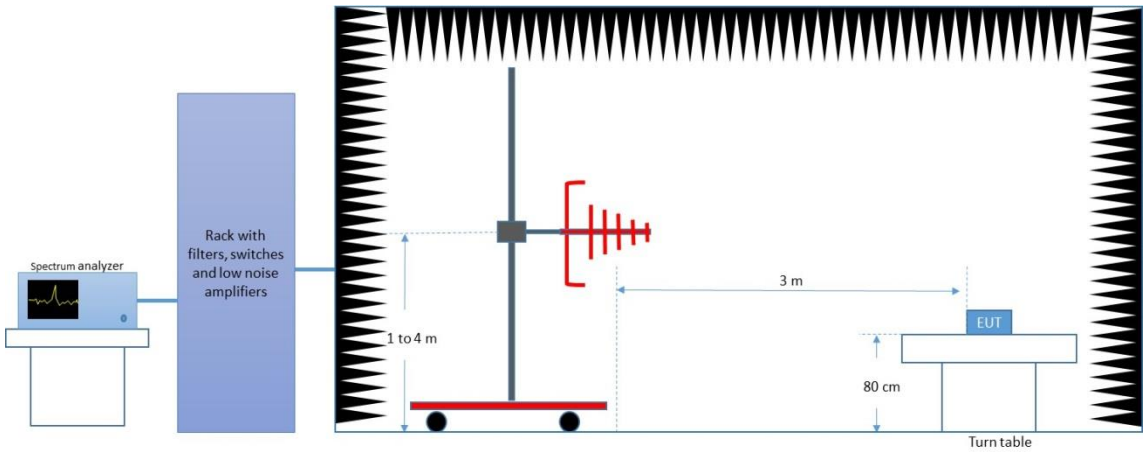
Emission Bandwidth Measurement Setup (57 – 64 GHz)



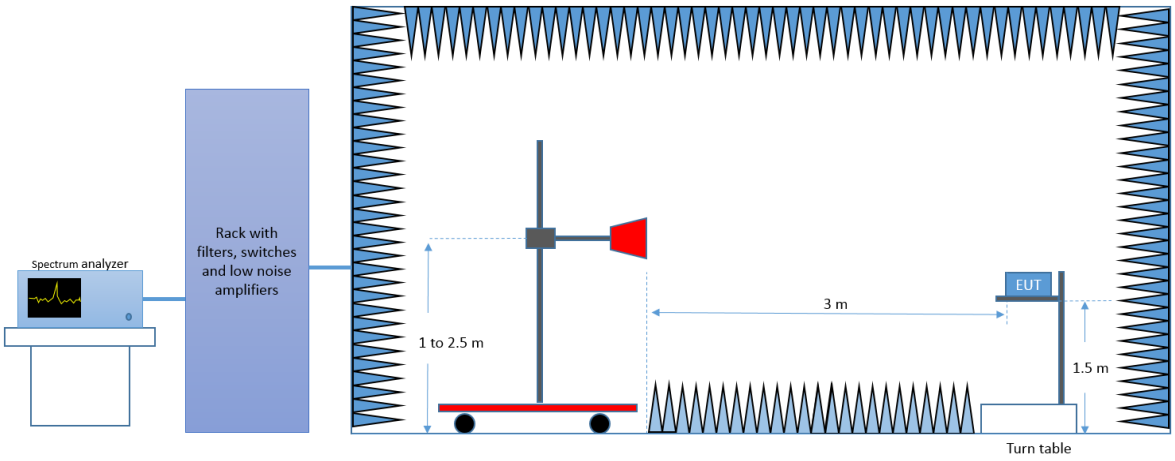
RF Detector Measurement Setup (57 – 64 GHz)



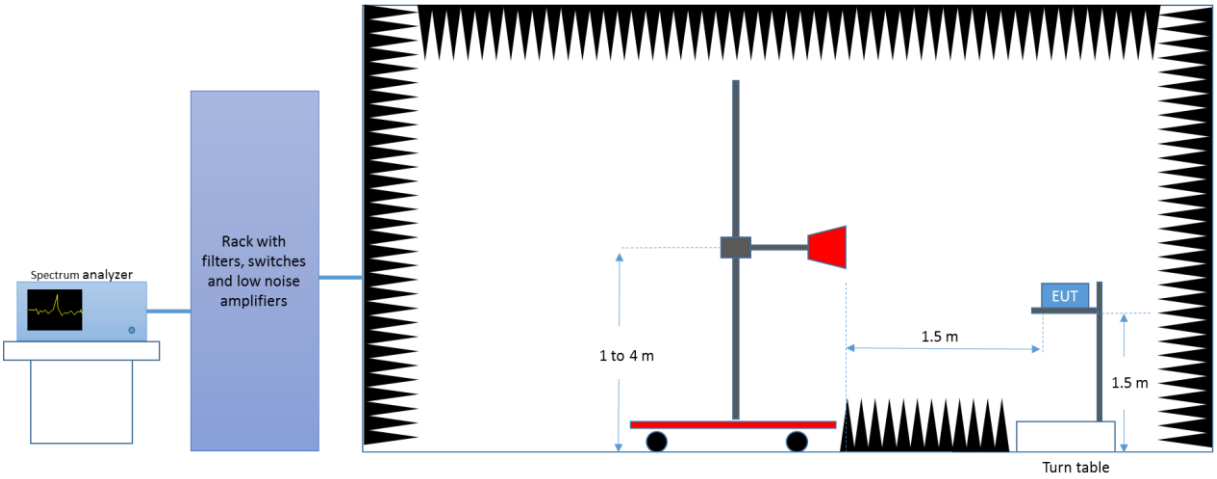
Radiated Setup (30 MHz – 1 GHz)



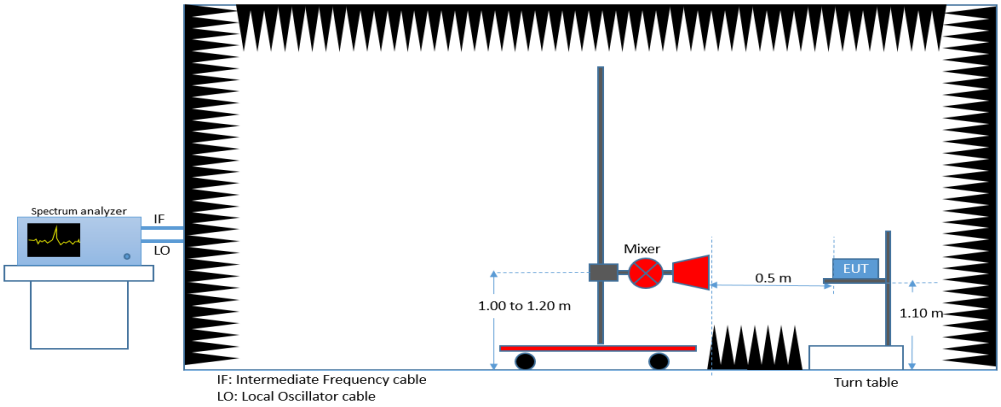
Radiated Setup (1 GHz – 18 GHz)



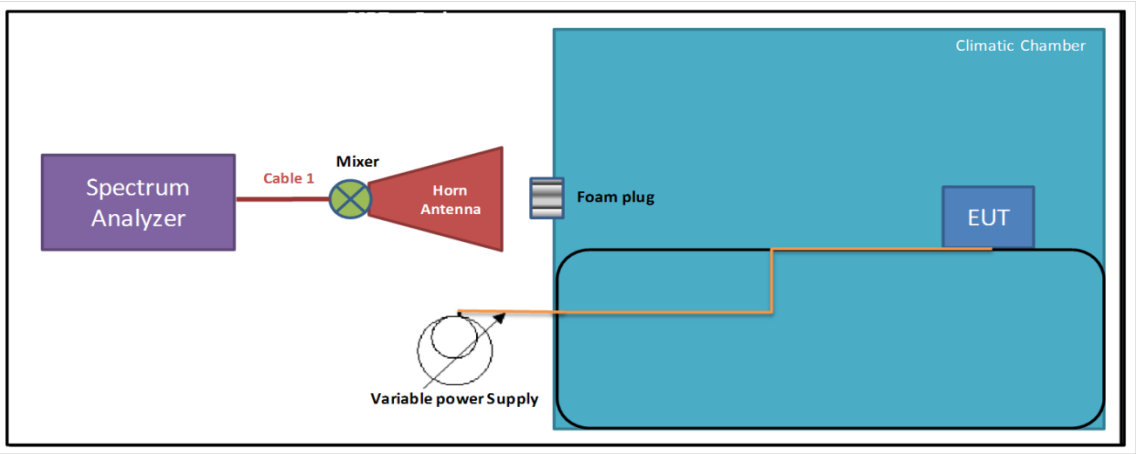
Radiated Setup (18 GHz – 40 GHz)



Radiated Setup (40 GHz – 200 GHz)



Frequency Stability Measurement Setup (57 – 64 GHz)



A.3 Test Equipment List

A.3.1 Radiated Setup-1 (Below 40 GHz)

ID#	Device	Type/Model	Serial #	Manufacturer	Cal. Date	Cal. Due Date
0133	Spectrum analyzer	FSV40	101358	Rohde & Schwarz	2016-04-15	2018-04-15
0135	Semi Anechoic chamber	FACT 3	5720	ETS Lindgren	2016-04-28	2018-04-28
0137	Log antenna 30 MHz – 1 GHz	3142E	00156946	ETS Lindgren	2017-12-19	2019-12-19
0139	Horn Antenna 18 GHz - 26.5 GHz	114514	00167100	ETS Lindgren	2016-03-16	2018-03-16
0140	Horn Antenna 26.5 GHz - 40 GHz	120722	00169638	ETS Lindgren	2016-07-26	2018-07-26
0296	Power Supply	6673A	MY41000318	Agilent	N/A	N/A
0530	Measurement Software	EMC32	100623	Rohde & Schwarz	N/A	N/A

N/A: Not Applicable

A.3.2 Radiated Setup-2 (Below 40 GHz)

ID#	Device	Type/Model	Serial #	Manufacturer	Cal. Date	Cal. Due Date
0138	Horn antenna 1 GHz – 6.4 GHz	3117	00152266	ETS Lindgren	2016-03-14	2018-03-14
0141	Double Ridged Horn Antenna 1 GHz – 18 GHz	3117	00157736	ETS Lindgren	2016-04-13	2018-04-13
0329	Measurement Software	EMC32	100401	Rohde & Schwarz	N/A	N/A
0337	Full Anechoic chamber	RFD_FA_100	5996	ETS Lindgren	2016-04-28	2018-04-28
0420	Spectrum analyzer	FSV40	101556	Rohde & Schwarz	2016-04-14	2018-04-14

N/A: Not Applicable

A.3.3 Radiated Setup-3 (Above 40 GHz)

ID#	Device	Type/Model	Serial #	Manufacturer	Cal. Date	Cal. Due Date
0015	Spectrum Analyzer	FSU67	100092	R&S	2017-04-26	2019-04-26
0419	Spectrum Analyzer	FSW67	103266		2018-01-17	2020-01-17
0064	Antenna (40-60 GHz)	FH-SG-060-25	20011		N/A	N/A
0068	Antenna (60-90 GHz)	FH-SG-090-25	-		N/A	N/A
0069	Antenna (75-110GHz)	FH-SG-110-25	-		N/A	N/A
0070	Antenna (110 - 170 GHz)	FH-SG-170-25	-		N/A	N/A
0071	Antenna (140 - 220 GHz)	FH-SG-220-25	-	RPG	N/A	N/A
0066	Antenna (50-75 GHz)	FH-SG-075-25	20012		N/A	N/A
0057	MIXER 40 - 60 GHz	FS-Z60	100130	R&S	N/A	N/A
0422	MIXER 60 - 90 GHz	FS-Z90	101646		N/A	N/A
0435	MIXER 75 - 110 GHz	FS-Z110	101449		N/A	N/A
0433	MIXER 110 - 170 GHz	SAM-170	100957	RPG	N/A	N/A
0062	MIXER 140 - 200 GHz	SAM-220	20012	R&S	N/A	N/A
0381	Anechoic chamber	Screening Box Screen	BD25001	Franconia	N/A	N/A
0027	Measurement Software	EMC32	1300.7010.02	R&S	N/A	N/A
0312	Digital Oscilloscope	RTE1052	101135	R&S	2017-03-13	2019-03-13
0572	RF Detector	DET15RPFW0	72	Millitech	N/A	N/A
0427	Frequency Multiplier, 50GHz-75GHz	SMZ75	101257	R&S	N/A	N/A
0309	Signal Generator	SMB100A	178217		2017-03-15	2019-03-15
0012	Power Meter	NRP2	101567		N/A	N/A
0014	Power Sensor	NRP-Z57	101280		2017-04-25	2019-04-25
0300	Climatic Chamber	SLT34/40	56746020930010	SECASI	2017-03-09	2019-03-09

A.4 Measurement Uncertainty Evaluation

The system uncertainty evaluation is shown in the below table:

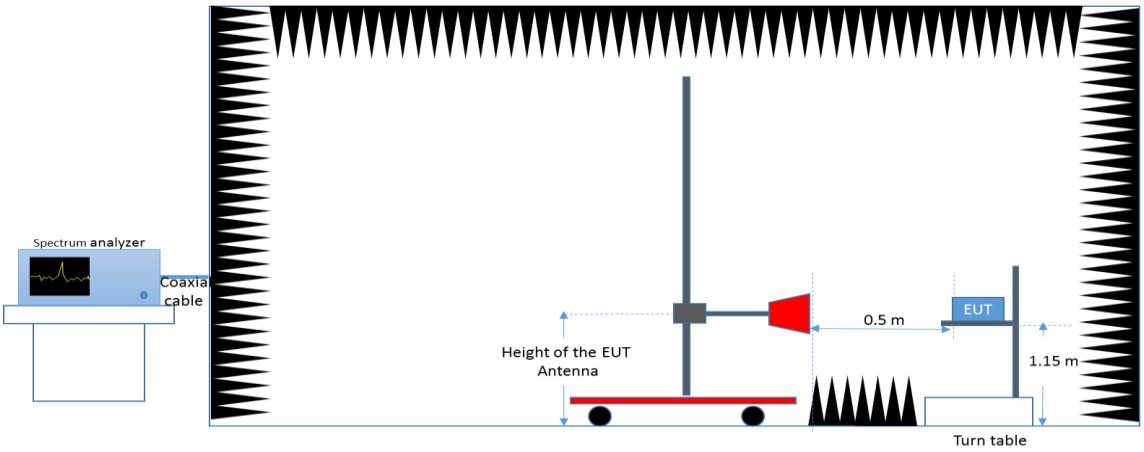
Measurement type	Uncertainty [±dB]
Radiated tests for power Measurement (57-66G)	±3.4
Radiated spurious tests < 1GHz	±3.8
Radiated Spurious tests 1 GHz - 40GHz	±4.7
Radiated Spurious tests 40GHz - 200GHz	±4.7

Annex B. Test Results

B.1 Emission Bandwidth

B.1.1 Test procedure

The setup below was used to measure the 6dB & 99% Bandwidth. The measurement antenna covering the band (50-75G) is connected to the spectrum analyzer through a coaxial cable. The Spectrum analyzer is able to measure directly up to 67GHz. The EUT is configured to operate at the Modulation and Coding Scheme index (*MCS*) giving the maximum output power (MCS 1)[1].



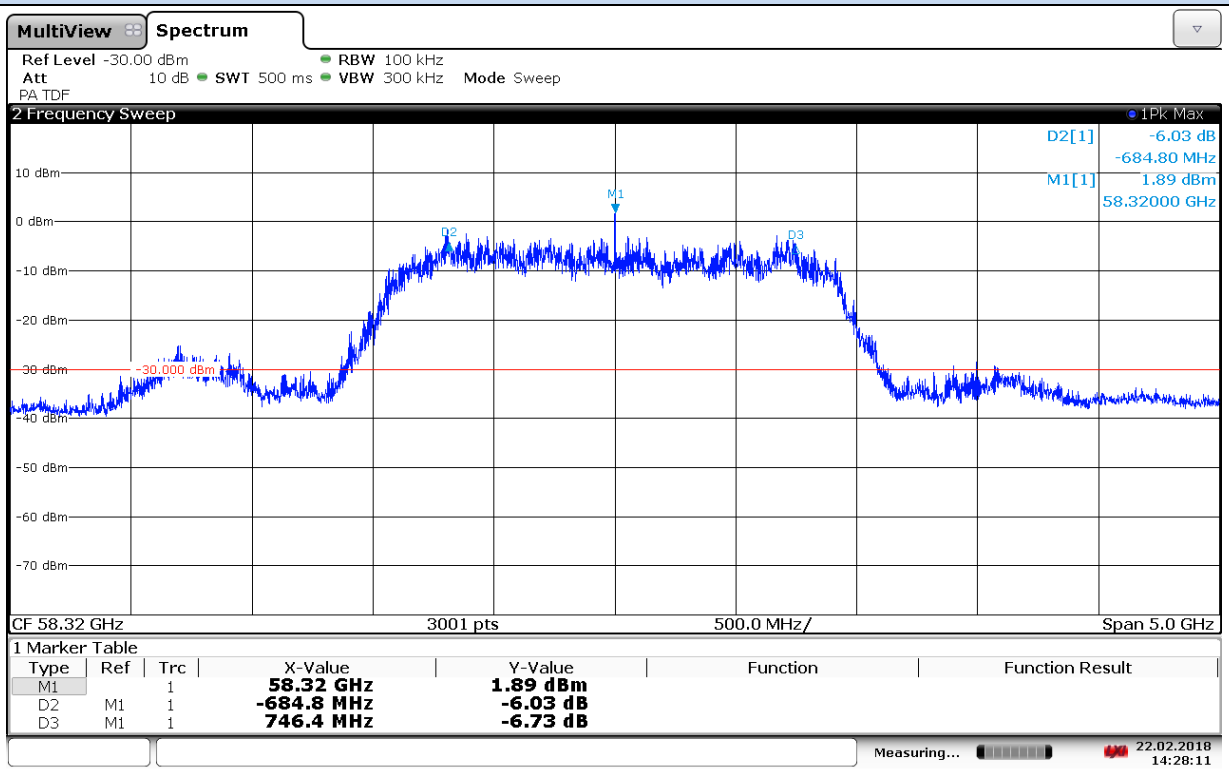
B.1.2 Results tables

Emission Bandwidths					
Mode	MCS	Channel	Frequency (GHz)	6 dB Bandwidth (GHz)	99% Bandwidth (GHz)
WiGig	1	1	58.32	1.431	1.947
WiGig	1	2	60.48	1.529	1.892
WiGig	1	3	62.64	1.298	1.969

[1] *MSC 1 corresponds to π/2 BPSK Modulation type with a coding rate of (1/4) including repetition*

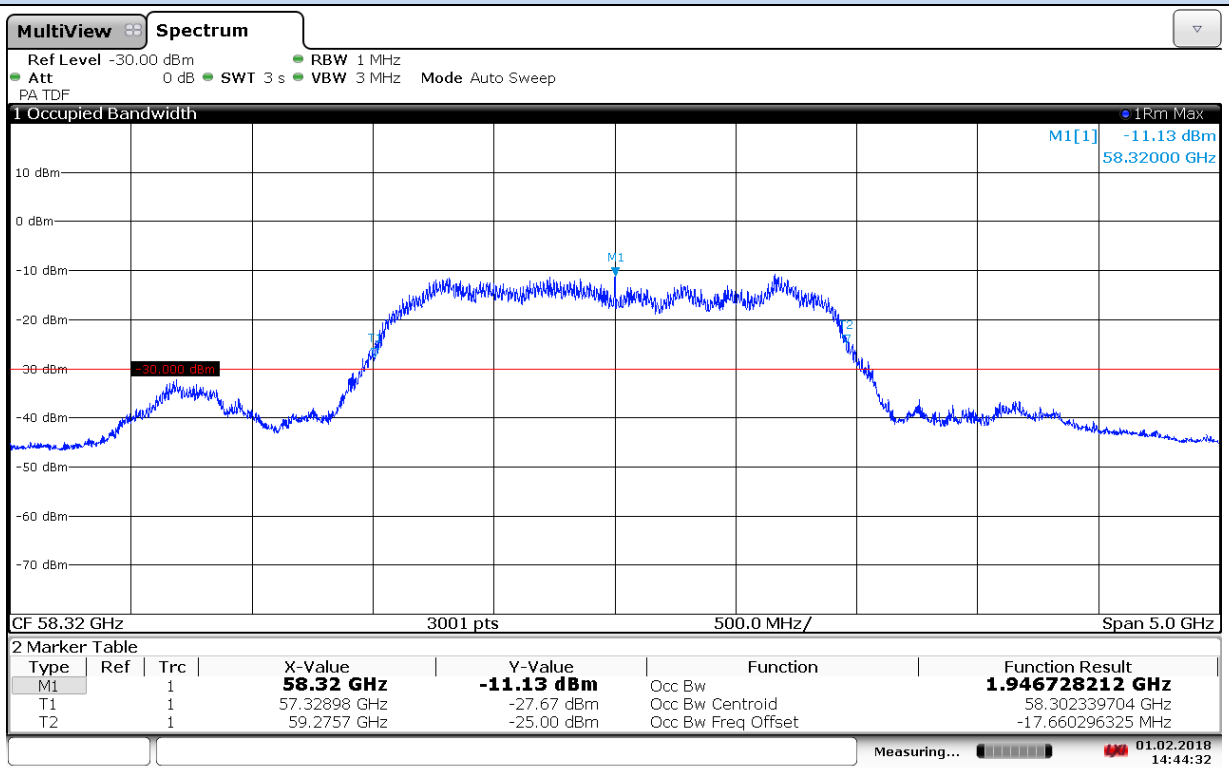
B.1.3 Results screenshots

6dB BW - Channel 1 – MCS 1



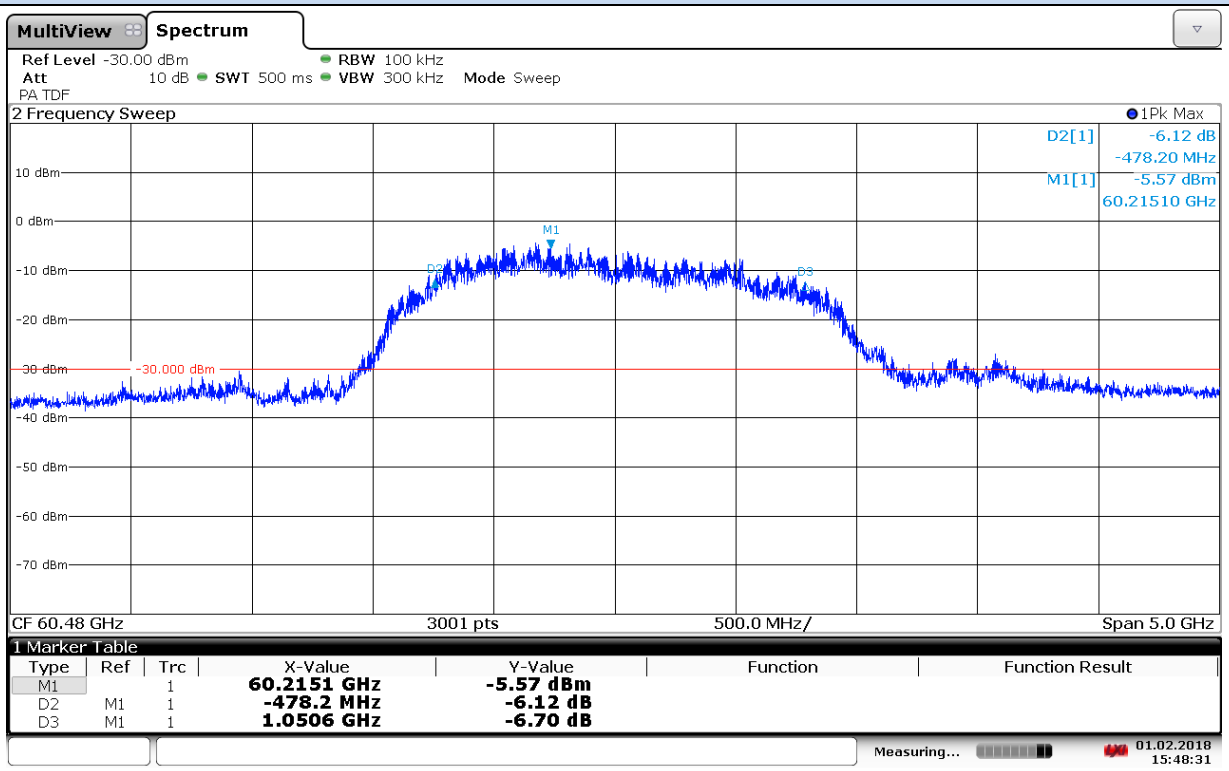
14:28:11 22.02.2018

99 % BW - Channel 1 – MCS 1



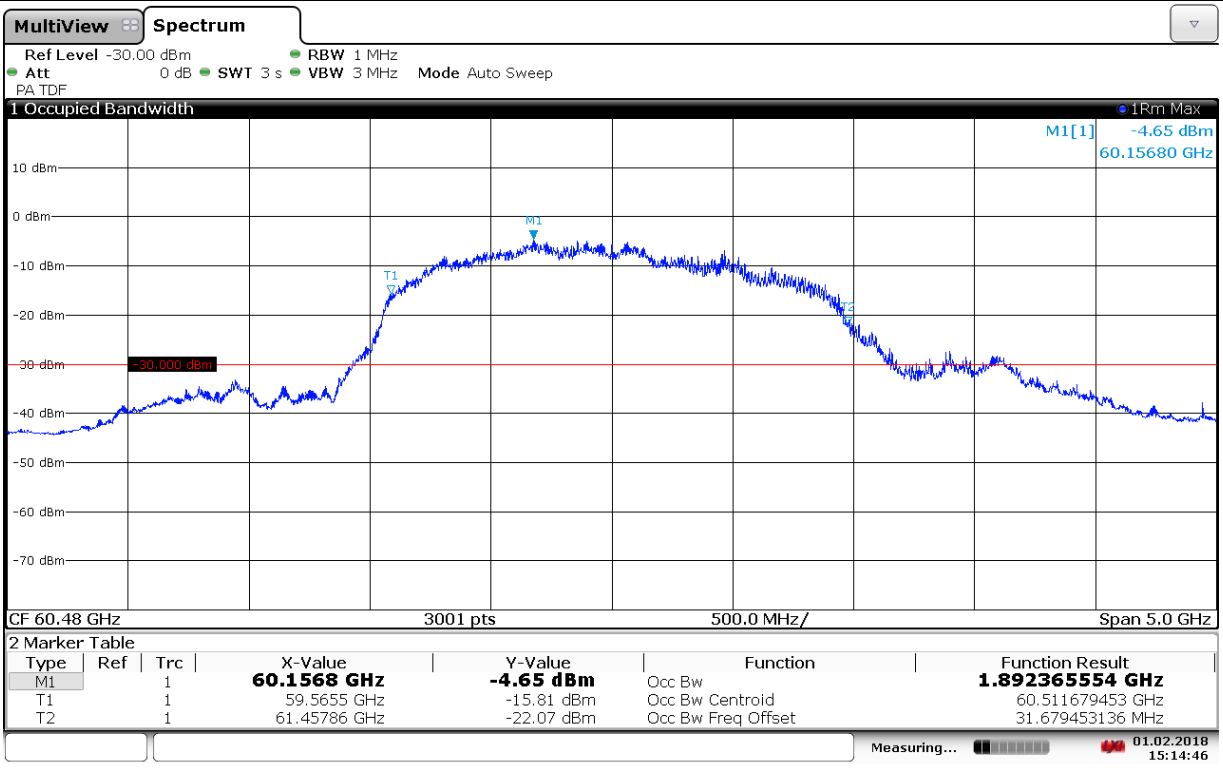
14:44:32 01.02.2018

6dB BW - Channel 2 – MCS 1



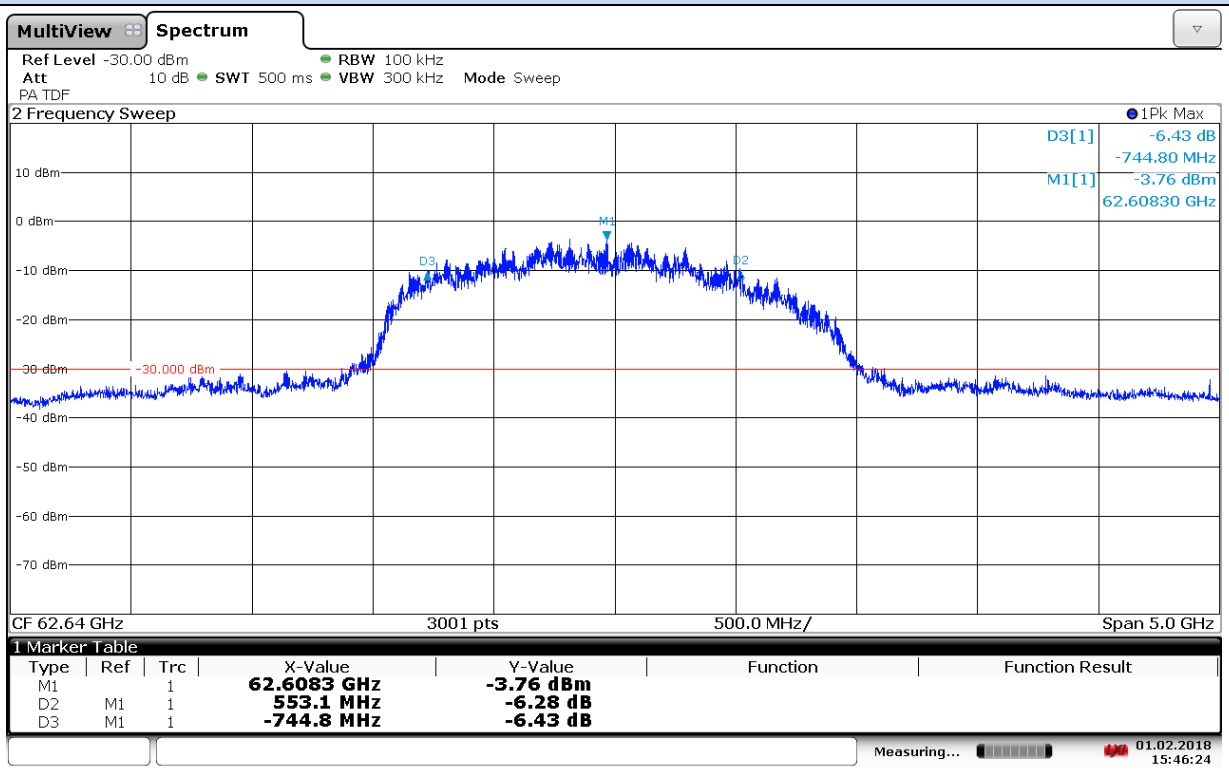
15:48:31 01.02.2018

99 % BW - Channel 2 – MCS 1



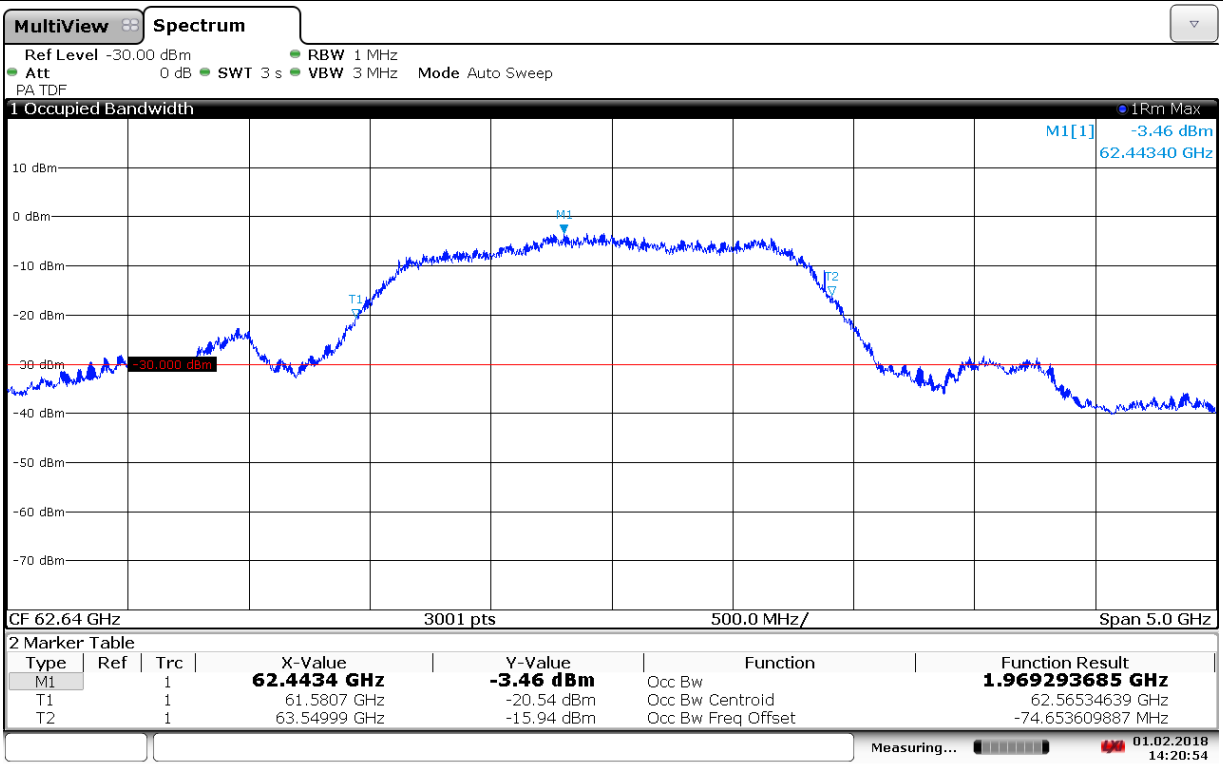
15:14:47 01.02.2018

6dB BW - Channel 3 – MCS 1



15:46:25 01.02.2018

99 % BW - Channel 3 – MCS 1



14:20:55 01.02.2018

B.2 Peak and Average Power, RF detector

B.2.1 Test limits

FCC part	RSS part	Limits
15.255 (c) (1)(i)	RSS-210 Annex J.2.1.a	Within the 57-71 GHz band, emission levels shall not exceed the following equivalent isotropically radiated power (EIRP): the average power of any emission shall not exceed 40 dBm (equivalent to 9 μW/cm^2 power density at 3m) and the peak power of any emission shall not exceed 43 dBm (equivalent to 18 μW/cm^2 power density at 3m)

B.2.2 Test procedure

1. According to ANSI C63.10-2013, Clause 9, the measurement should be performed at a distance greater than or equal to the far field boundary distance. This later is given by

$$R_{(Far\ Field)} = \frac{2L^2}{\lambda}$$

Where
L is the largest dimension of the transmit antenna in m
λ is the *w*avelength in m

Far field boundary calculation			
Frequency (GHz)	Wavelength (λ) (m)	L (m)	R far field (m)
58.32	0.0051	0.025	0.24
60.48	0.0050	0.025	0.25
62.64	0.0048	0.025	0.26

Our measurement is performed at a minimum distance of **0.45m** > R far field

2. The EUT is configured to operate at the Modulation and Coding Scheme index (MCS) giving the maximum output power (MCS 1).

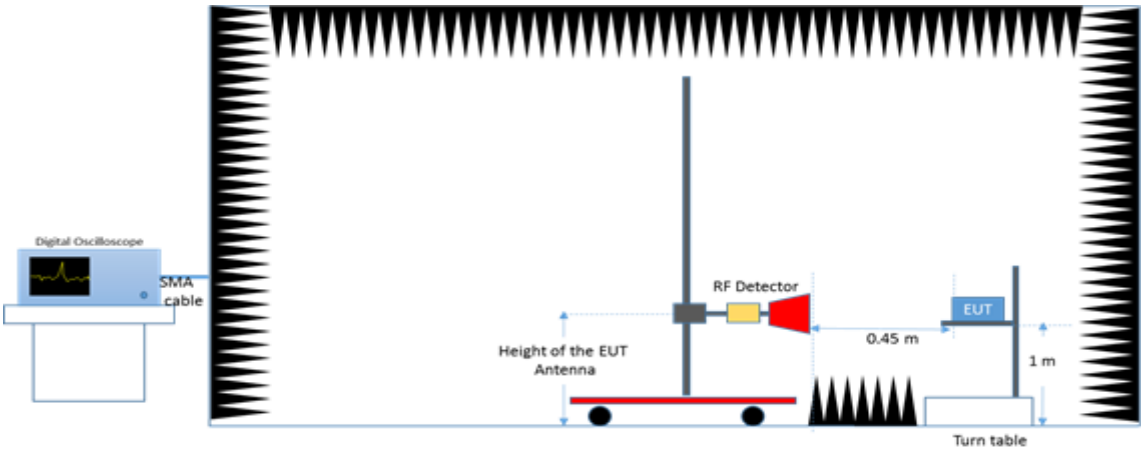
3. Referring to ANSI C63.10-2013, Clause 9, the equivalent Peak and Average Power obtained using the RF detector measured voltage* (see setup below) are converted to EIRP using Friis equation and then compared to the limits.

$$EIRP(W) = \frac{P_R}{G_R}.\left(\frac{4\pi D}{\lambda}\right)^2 \text{ and } EIRP(dBm) = 30 + 10\ Log_{10}\left(EIRP_{(W)}\right)$$

Where:

P_R is the equivalent power measured at the output of the test antenna, in W
λ is the wavelength of the emission under investigation in m
G_R is the linear gain of the test antenna
D is the measurement distance in m

** The conversion from the measured voltage to the equivalent power is done by a substitution measurement using the frequency Multiplier, 50GHz-75GHz and the power sensor (DC-67G) (see Test Equipment List).*



B.2.3 Results tables:

Peak EIRP									
Mode	MCS	Freq. (GHz)	D (m)	Measured Peak Voltage (mV)	P_R (dBm)	Rx Antenna Gain G_R (dBi)	EIRP (W)	EIRP (dBm)	Limit (dBm)
WiGig	1	58.32	0.5	1.83	-13.68	24.37	0.23	23.69	43
WiGig	1	60.48	0.5	3.15	-10.3	24.71	0.5	27.04	43
WiGig	1	62.64	0.45	4.54	-9.03	25.00	0.55	27.41	43

Average EIRP									
Mode	MCS	Freq. (GHz)	D (m)	Measured Average Voltage (mV)	P_R (dBm)	Rx Antenna Gain G_R (dBi)	EIRP (W)	EIRP (dBm)	Limit (dBm)
WiGig	1	58.32	0.5	1.63	-14.56	24.37	0.19	22.81	40
WiGig	1	60.48	0.5	2.90	-11.1	24.71	0.42	26.24	40
WiGig	1	62.64	0.45	4.17	-10.05	25.00	0.44	26.39	40

B.3 Conducted Peak Output Power, RF detector

B.3.1 Test limits

FCC part	RSS part	Limits
15.255 (e) (1)	RSS-210 Issue 9 Annex J.4	The peak transmitter conducted output power shall not exceed 500 mW. Depending on the gain of the antenna, it may be necessary to operate the intentional radiator using a lower peak transmitter output power in order to comply with the EIRP limits specified in paragraph (b) of this section. Transmitters with an emission bandwidth of less than 100 MHz must limit their peak transmitter conducted output power to the product of 500 mW times their emission bandwidth divided by 100 MHz. For the purposes of this paragraph, emission bandwidth is defined as the instantaneous frequency range occupied by a steady state radiated signal with modulation, outside which the radiated power spectral density never exceeds 6 dB below the maximum radiated power spectral density in the band, as measured with a 100 kHz resolution bandwidth spectrum analyzer. The center frequency must be stationary during the measurement interval, even if not stationary during normal operation (e.g., for frequency hopping devices).

B.3.2 Test procedure

The peak output power in dBm is calculated by subtracting the DUT gain in dBi from the Peak EIRP in dBm found in section B.2.

B.3.3 Results tables:

Peak Output Power								
Mode	MCS	Freq. (GHz)	Peak EIRP (dBm)	EUT Antenna Gain (dBi)	Output Power (dBm)	Output Power (mW)	6 dB Bandwidth (GHz)	Limit (mW)
WiGig	1	58.32	23.69	15.3	8.39	6.90	1.431	500
WiGig	1	60.48	27.04	15.2	11.84	15.28	1.529	500
WiGig	1	62.64	27.41	14.8	12.61	18.25	1.298	500

B.4 Spurious Emissions

B.4.1 Test limits

<table>
<tr><th>FCC part</th><th>RSS part</th><th>Limits</th></tr>
<tr><td>15.255 (d) (1) (2) (3) (4)</td><td>RSS-210 Annex J.3</td><td>(c) (1): The power density of any emissions outside the 57-71 GHz band shall consist solely of spurious emissions.

(c) (2): Radiated emissions below 40 GHz shall not exceed the general limits in §15.209.

(c) (3): Between 40 GHz and 200 GHz, the level of these emissions shall not exceed 90 pW/cm^2 at a distance of 3 meters.

(c) (4): The levels of the spurious emissions shall not exceed the level of the fundamental emission.

(d): Only spurious emissions and transmissions related to a publicly-accessible coordination channel, whose purpose is to coordinate operation between diverse transmitters with a view towards reducing the probability of interference throughout the 57-64 GHz band, are permitted in the 57-57.05 GHz band.

Note to paragraph (d): The 57-57.05 GHz is reserved exclusively for a publicly-accessible coordination channel. The development of standards for this channel shall be performed pursuant to authorizations issued under part 5 of this chapter.</td></tr>
<tr><td>15.209</td><td>RSS-Gen Clause 8.9</td><td>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):

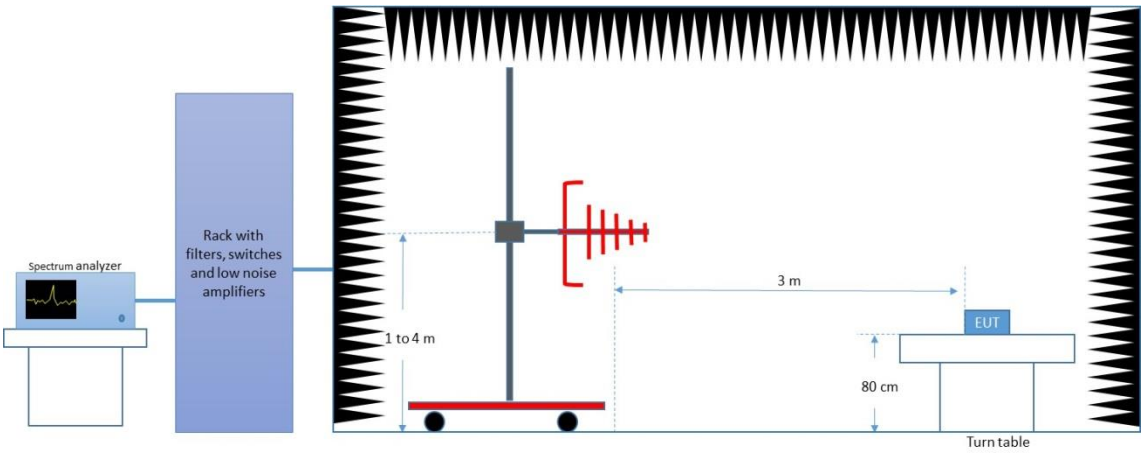
<table>
<tr><th>Freq Range (MHz)</th><th>Field Stregth (µV/m)</th><th>Field Stregth (dBµV/m)</th><th>Meas. Distance (m)</th></tr>
<tr><td>0.009-0.490</td><td>2400/f(kHz)</td><td>-</td><td>300</td></tr>
<tr><td>0.490-1.705</td><td>24000/f(kHz)</td><td>-</td><td>300</td></tr>
<tr><td>1.705-30.0</td><td>30</td><td>-</td><td>30</td></tr>
<tr><td>30-88</td><td>100</td><td>40</td><td>3</td></tr>
<tr><td>88-216</td><td>150</td><td>43.5</td><td>3</td></tr>
<tr><td>216-960</td><td>200</td><td>46</td><td>3</td></tr>
<tr><td>960-25000</td><td>500</td><td>54</td><td>3</td></tr>
</table>

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.
For average radiated emission measurements above 1000 MHz, there is also a limit specified when measuring with peak detector function, corresponding to 20 dB above the indicated values in the table.</td></tr>
</table>

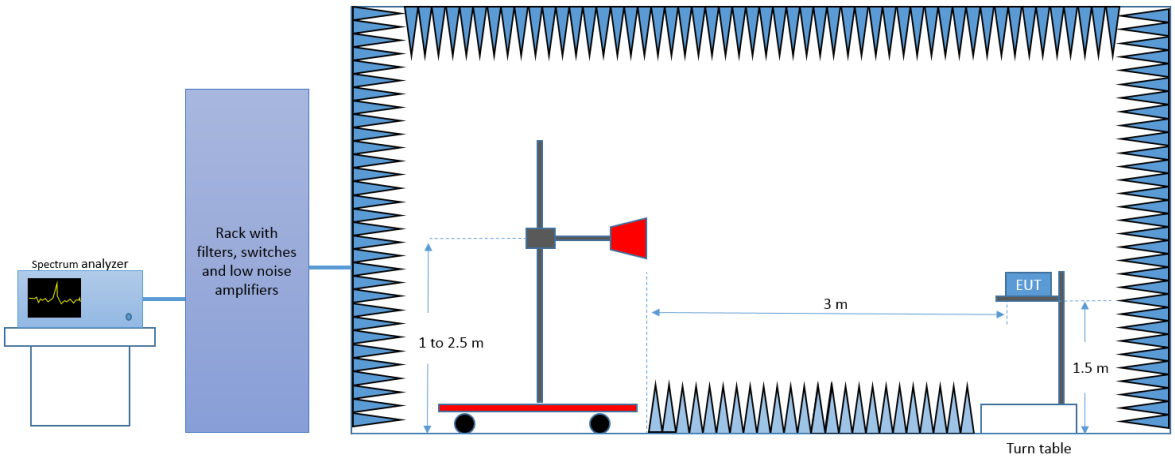
B.4.2 Test procedure

1. The spurious emissions are measured for the Modulation and Coding Scheme index (MCS1) giving the maximum output power.
2. The setups presented below were used to measure the radiated spurious emissions.
    1. **From 30 MHz to 40 GHz**: Depending of the frequency range and bands being tested, different antennas and filters were used. The final measurement is done by varying the antenna height from 1 to 4 meters, the EUT azimuth over 360º and for both Vertical and Horizontal polarizations.
    2. **From 30MHz to 18GHz:** The measurements are done at the specification distance (3m) and the measured field strength is directly compared to the limit.
    3. **From 18GHz to 40GHz:** The measurements are done at a distance of (1.5m) then the measured field strength is extrapolated at the distance specified by the limit (3m) using an inverse distance correction factor (20 dB/decade of distance).
    4. **From 40 GHz to 200 GHz:** Depending of the frequency range and bands being tested, different antennas and mixers were used. The final measurement is done by varying the antenna height from 1.00 to 1.20 meters, the EUT azimuth over 360º and for both Vertical and Horizontal polarizations. The EIRP (dBm) is measured, then the power density at 3m is calculated and compared to the limit.

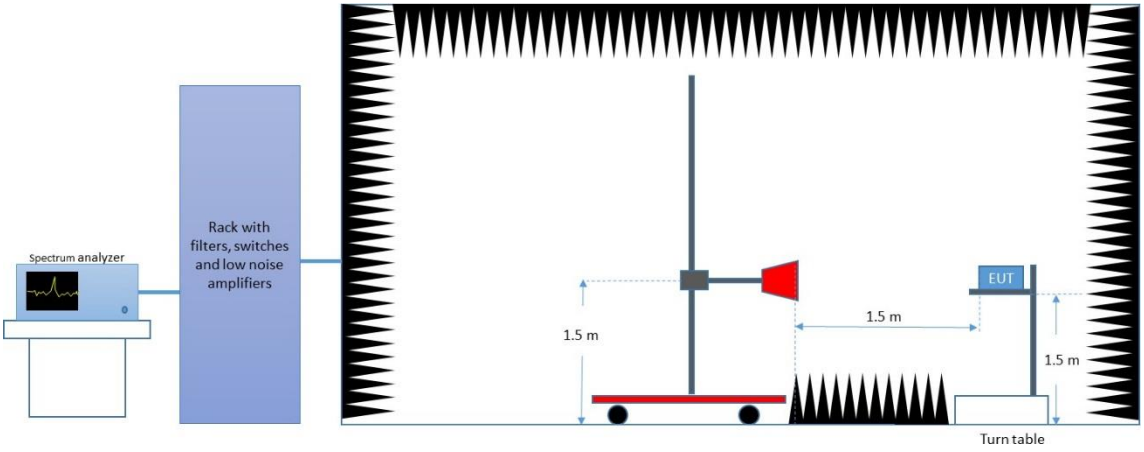
Radiated Setup (30 MHz – 1 GHz)



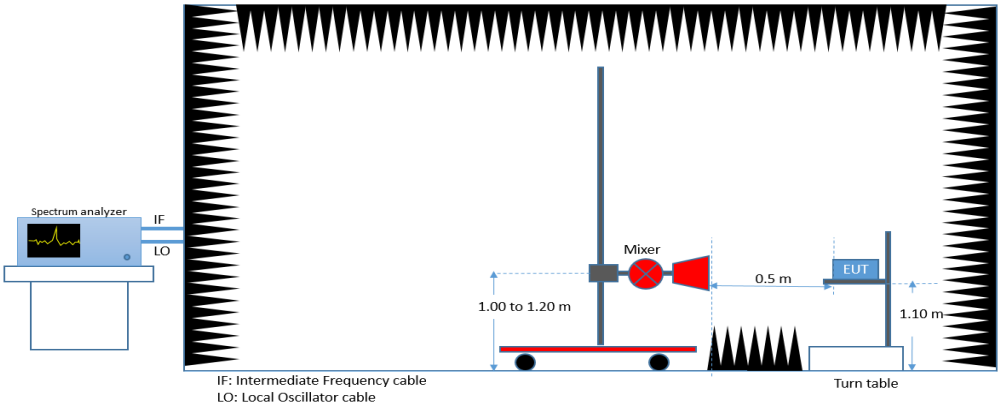
Radiated Setup (1 GHz – 18 GHz)



Radiated Setup (18 GHz – 40 GHz)



Radiated Setup (40 GHz – 200 GHz)



Sample Calculation

The field strength is deduced from the radiated measurement using the following equation:

$$E = 126.8 - 20\log(\lambda) + P - G$$

Where:

E is the field strength of the emission at the measurement distance, in dBµV/m

P is the power measured at the output of the test antenna, in dBm

λ is the wavelength of the emission under investigation [300/f_{MHz}], in m

G is the gain of the test antenna, in dBi

NOTE – The measured power P includes all applicable instrument correction factors up to the connection to the test

Antenna e.g. cable losses, amplifier gains.

For field strength measurements made at other than the distance at which the applicable limit is specified, the field strength of the emission at the distance specified by the limit is deduced as follows:

$$E_{SpecLimit} = E_{Meas} + 20\log(D_{Meas}/D_{SpecLimit})$$

Where:

$E_{SpecLimit}$ is the field strength of the emission at the distance specified by the limit, in dBµV/m

E_{Meas} is the field strength of the emission at the measurement distance, in dBµV/m

D_{Meas} is the measurement distance, in m

$D_{SpecLimit}$ is the distance specified by the limit, in m

In the band 40 GHz – 200 GHz the field strength is expressed in terms of power density and compared to the limit in pW/cm^2 at the specified distance. The conversion is done as follows:

$$PD\ (pW/cm^2) = (10^8/377) * (10^{[(E_{SpecLimit} - 120)/20]})^2$$

Where:

PD is the power density at the distance specified by the limit, in pW/cm^2

$E_{SpecLimit}$ is the field strength of the emission at the distance specified by the limit, in dBµV/m

B.4.3 Tests Results

30 MHz – 40 GHz

Radiated Spurious – CH1 – MCS1

Frequency	MaxPeak	Avg	Limit	Margin
MHz	dBµV/m	dBµV/m	dBµV/m	dB
199.2	33.8	---	43.6	9.8
298.7	44.0	---	46.0	2.0
497.8	36.8	---	46.0	9.2
697.2	38.6	---	46.0	7.4
1320.0	---	36.3	54.0	17.7
1473.0	---	35.9	54.0	18.1
2492.7	---	39.1	54.0	14.9
10515.1	---	48.1	54.0	5.9
10625.3	---	49.1	54.0	4.9
10924.0	---	49.5	54.0	4.5
11001.3	59.5	---	74.0	14.5
11027.4	---	50.3	54.0	3.7
11141.0	---	50.7	54.0	3.3
11144.4	---	51.4	54.0	2.6
11222.7	---	51.2	54.0	2.8
11230.4	---	53.5	54.0	0.5
11233.8	---	53.2	54.0	0.8
11236.7	61.1	---	74.0	12.9
11245.9	---	51.4	54.0	2.6
11278.3	---	52.9	54.0	1.1
11309.2	---	53.6	54.0	0.4
21120.0	---	36.4	54.0	17.6
21120.0	42.9	---	74.0	31.1
23879.6	42.0	---	74.0	32.0
23880.1	---	35.2	54.0	18.8
36225.3	46.3	---	74.0	27.7
36230.1	---	33.9	54.0	20.1

Radiated Spurious – CH2 – MCS1

Frequency	MaxPeak	Avg	Limit	Margin
MHz	dBµV/m	dBµV/m	dBµV/m	dB
120.0	31.8	---	43.6	11.8
199.9	34.2	---	43.6	9.4
299.9	44.2	---	46.0	1.8
497.8	37.1	---	46.0	8.9
599.9	36.5	---	46.0	9.5
699.8	39.0	---	46.0	7.0
1197.1	---	34.7	54.0	19.3
1320.0	---	37.1	54.0	16.9
1471.2	---	35.1	54.0	18.9
1598.5	---	34.5	54.0	19.5
2495.4	---	39.4	54.0	14.6
4999.2	56.8	---	74.0	17.2
9875.7	---	44.3	54.0	9.7
10374.5	---	44.5	54.0	9.5
10456.6	---	44.8	54.0	9.2
10559.6	---	44.4	54.0	9.6
10920.6	---	47.5	54.0	6.5
10999.4	---	44.2	54.0	9.8
10999.4	58.3	---	74.0	15.7
11144.4	---	47.8	54.0	6.2
11230.4	---	48.6	54.0	5.4
11237.2	58.5	---	74.0	15.5
11305.8	---	49.7	54.0	4.3
11377.9	---	47.3	54.0	6.7
24960.1	42.8	---	74.0	31.2
24960.1	---	37.9	54.0	16.1
38640.4	46.1	---	74.0	27.9
38640.8	---	32.5	54.0	21.5

Radiated Spurious – CH3 – MCS1

Frequency	MaxPeak	Avg	Limit	Margin
MHz	dBµV/m	dBµV/m	dBµV/m	dB
39.7	34.3	---	40.0	5.7
199.1	33.3	---	43.6	10.3
216.0	33.5	---	43.6	10.1
299.9	44.5	---	46.0	1.5
699.6	39.2	---	46.0	6.8
1320.0	---	37.3	54.0	16.7
2498.5	---	38.6	54.0	15.4
4995.6	55.9	---	74.0	18.1
10559.6	---	43.8	54.0	10.2
10913.9	---	42.8	54.0	11.2
11137.6	---	43.7	54.0	10.3
11233.3	---	44.1	54.0	9.9
11233.3	55.0	---	74.0	19.0
11305.8	---	45.4	54.0	8.6
11385.1	---	44.4	54.0	9.6
26040.1	---	34.4	54.0	19.6
26040.5	41.7	---	74.0	32.3
37196.8	47.8	---	74.0	26.2
37200.2	---	34.0	54.0	20.0

40 GHz – 200 GHz

Radiated Spurious – CH1 – MCS1

Freq. (GHz)	EIRP (dBm)	Meas. Dist (m)	Spec. Dist (m)	Power Density @ 3m (pW/cm^2)	Limit (pW/cm^2)
47.76	-48.67	0.5	3	0.012	90
67.99	-37.87	0.5	3	0.144	90

No other spurious identified up to 200 GHz with level above the value reported in the table.

Radiated Spurious – CH2– MCS1

Freq. (GHz)	EIRP (dBm)	Meas. Dist (m)	Spec. Dist (m)	Power Density @ 3m (pW/cm^2)	Limit (pW/cm^2)
49.92	-53.98	0.5	3	0.0035	90
70.16	-42.77	0.5	3	0.047	90

No other spurious identified up to 200 GHz with level above the value reported in the table.

Radiated Spurious – CH3 – MCS1

Freq. (GHz)	EIRP (dBm)	Meas. Dist (m)	Spec. Dist (m)	Power Density @ 3m (pW/cm^2)	Limit (pW/cm^2)
51.53	-39.37	0.5	3	0.102	90
68.10	-43.27	0.5	3	0.042	90
109.81	-39.45	0.5	3	0.100	90

No other spurious identified up to 200 GHz with level above the value reported in the table.

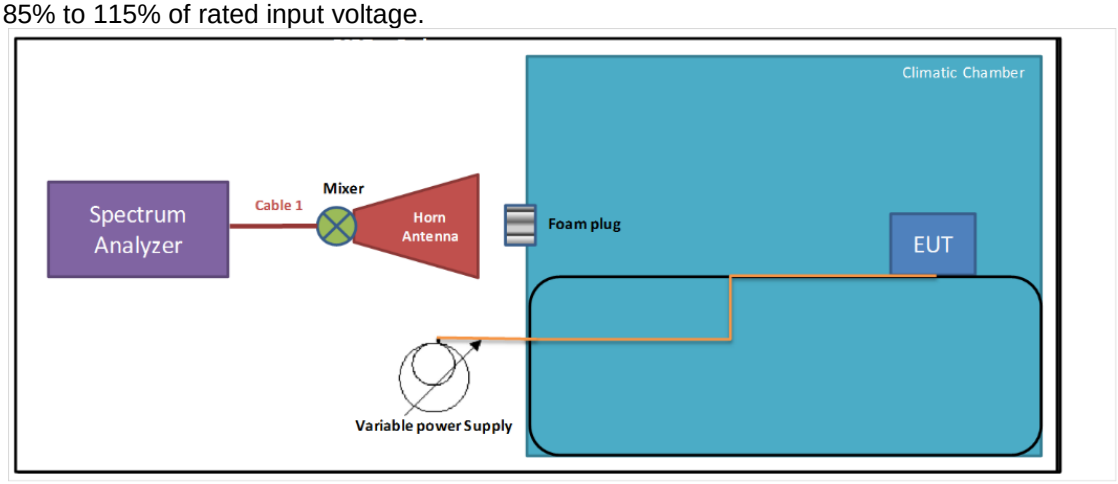
B.5 Frequency Stability

B.5.1 Test limits

FCC part	RSS part	Limits
15.255 (f)	RSS-210 Annex J.6	Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range −20 to + 50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

B.5.2 Test procedure

1. Measurements are performed for the highest and lowest frequency of operation and with the modulation that produces the widest emission bandwidth (MCS1) according to the setup below.
2. These measurements are repeated for each step of temperature variation from (-20 to 50 ºC) at the nominal voltage.
3. These measurements are repeated for an input voltage variation of 85% to 110% at the reference temperature
4. The frequency excursion is recorded by checking at each time if the 20 dB bandwidth of the fundamental emission is contained within the frequency band over the temperature range -20 to +50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage.



B.5.3 Results tables

Lowest frequency of operation (Channel 1)			
Power Supply (VDC)	Environment Temperature (°C)	Min Frequency (GHz) @ 20dB BW	Limit
3.3	50	57.263380	57 GHz
3.3	40	57.262380	57 GHz
3.3	30	57.268630	57 GHz
3.3	20	57.219380	57 GHz
3.3	10	57.247130	57 GHz
3.3	0	57.268630	57 GHz
3.3	-10	57.259380	57 GHz
3.3	-20	57.261630	57 GHz
2.805	20	57.255880	57 GHz
3.795	20	57.247380	57 GHz

Highest frequency of operation (Channel 3)			
Power Supply (VDC)	Environment Temperature (°C)	Max Frequency (GHz) @ 20dB BW	Limit
3.3	50	63.623560	64 GHz
3.3	40	63.605440	64 GHz
3.3	30	63.623310	64 GHz
3.3	20	63.613690	64 GHz
3.3	10	63.606810	64 GHz
3.3	0	63.607190	64 GHz
3.3	-10	63.627190	64 GHz
3.3	-20	63.658190	64 GHz
2.805	20	63.626940	64 GHz
3.795	20	63.630190	64 GHz

B.6 Group Installation

B.6.1 Test limits

FCC part	RSS part	Limits
15.255 (g)	RSS-210 Annex J.7	Any transmitter that has received the necessary FCC equipment authorization under the rules of this chapter may be mounted in a group installation for simultaneous operation with one or more other transmitter(s) that have received the necessary FCC equipment authorization, without any additional equipment authorization. However, no transmitter operating under the provisions of this section may be equipped with external phase-locking inputs that permit beam-forming arrays to be realized.

B.6.2 Results

According to applicant's declaration, there is no external Phase-Locking input to realize a beamforming array.

B.7 RF Exposure

B.7.1 Limits

<table>
<tr><th>FCC part</th><th>Limits</th></tr>
<tr><td>15.255 (g)</td><td>Regardless of the power density levels permitted under this section, devices operating under the provisions of this section are subject to the radiofrequency radiation exposure requirements specified in §§1.1307(b), 2.1091 and 2.1093 of this chapter, as appropriate. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.</td></tr>
<tr><td>2.1091</td><td>(b) For purposes of this section, a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. In this context, the term “fixed location” means that the device is physically secured at one location and is not able to be easily moved to another location. Transmitting devices designed to be used by consumers or workers that can be easily re-located, such as wireless devices associated with a personal computer, are considered to be mobile devices if they meet the 20 centimeter separation requirement.
(c)(2) Unlicensed personal communications service devices, unlicensed millimeter wave devices and unlicensed NII devices authorized under §§15.253(f), 15.255(g), 15.257(g), 15.319(i), and 15.407(f) of this chapter are also subject to routine environmental evaluation for RF exposure prior to equipment authorization or use if their ERP is 3 watts or more or if they meet the definition of a portable device as specified in §2.1093(b) requiring evaluation under the provisions of that section.</td></tr>
<tr><td>1.1310</td><td>(e) Table 1 below sets forth limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)
<table>
<tr><th>Frequency range (MHz)</th><th>Electric field strength (V/m)</th><th>Magnetic field strength (A/m)</th><th>Power density (mW/cm^2)</th><th>Averaging time (minutes)</th></tr>
<tr><td colspan="5">(A) Limits for Occupational/Controlled Exposure</td></tr>
<tr><td>0.3-3.0</td><td>614</td><td>1.63</td><td>*100</td><td>6</td></tr>
<tr><td>3.0-30</td><td>1842/f</td><td>4.89/f</td><td>$*900/f^2$</td><td>6</td></tr>
<tr><td>30-300</td><td>61.4</td><td>0.163</td><td>1.0</td><td>6</td></tr>
<tr><td>300-1,500</td><td></td><td></td><td>f/300</td><td>6</td></tr>
<tr><td>1,500-100,000</td><td></td><td></td><td>5</td><td>6</td></tr>
<tr><td colspan="5">(B) Limits for General Population/Uncontrolled Exposure</td></tr>
<tr><td>0.3-1.34</td><td>614</td><td>1.63</td><td>*100</td><td>30</td></tr>
<tr><td>1.34-30</td><td>824/f</td><td>2.19/f</td><td>$*180/f^2$</td><td>30</td></tr>
<tr><td>30-300</td><td>27.5</td><td>0.073</td><td>0.2</td><td>30</td></tr>
<tr><td>300-1,500</td><td></td><td></td><td>f/1500</td><td>30</td></tr>
<tr><td>1,500-100,000</td><td></td><td></td><td>1.0</td><td>30</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>RSS part</th><th>Limits</th></tr>
<tr><td>RSS-102</td><td>
3. Evaluation Methods
(…) Devices operating above 6 GHz regardless of the separation distance shall undergo an RF exposure evaluation.

4. Exposure Limits
For the purpose of this standard, Industry Canada has adopted the SAR and RF field strength limits established in Health Canada's RF exposure guideline, Safety Code 6.

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)
<table>
<tr><th>Frequency Range (MHz)</th><th>Electric Field (V/m rms)</th><th>Magnetic Field (A/m rms)</th><th>Power Density (W/m^2)</th><th>Reference Period (minutes)</th></tr>
<tr><td>0.003-10[21]</td><td>83</td><td>90</td><td>-</td><td>Instantaneous*</td></tr>
<tr><td>0.1-10</td><td>-</td><td>$0.73/f$</td><td>-</td><td>6**</td></tr>
<tr><td>1.1-10</td><td>$87/f^{0.5}$</td><td>-</td><td>-</td><td>6**</td></tr>
<tr><td>10-20</td><td>27.46</td><td>0.0728</td><td>2</td><td>6</td></tr>
<tr><td>20-48</td><td>$58.07/f^{0.25}$</td><td>$0.1540/f^{0.25}$</td><td>$8.944/f^{0.5}$</td><td>6</td></tr>
<tr><td>48-300</td><td>22.06</td><td>0.05852</td><td>1.291</td><td>6</td></tr>
<tr><td>300-6000</td><td>$3.142f^{0.3417}$</td><td>$0.008335f^{0.3417}$</td><td>$0.02619f^{0.6834}$</td><td>6</td></tr>
<tr><td>6000-15000</td><td>61.4</td><td>0.163</td><td>10</td><td>6</td></tr>
<tr><td>15000-150000</td><td>61.4</td><td>0.163</td><td>10</td><td>$616000/f^{1.2}$</td></tr>
<tr><td>150000-300000</td><td>$0.158f^{0.5}$</td><td>$4.21 \times 10^{-4} f^{0.5}$</td><td>$6.67 \times 10^{-5} f$</td><td>$616000/f^{1.2}$</td></tr>
<tr><td colspan="5">Note: f is frequency in MHz.
*Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).</td></tr>
</table>
</td></tr>
</table>

B.7.2 Test procedure

For the purpose of this evaluation, a minimum distance of 20cm was used to calculate the equivalent plan wave power density based on the Average EIRP values obtained in **Error! Reference source not found.**, to be compared with the ower density limit, according to following formula:

$$S_{eq} = \frac{P_{avg} \cdot G}{4 \cdot \pi \cdot R^2} \Rightarrow S_{eq} = \frac{EIRP}{4 \cdot \pi \cdot R^2}$$

Where:

S_{eq} = Equivalent Plane Wave Power Density, in Watts per square meter.

P_{avg} = Source-Based Average Power at antenna terminals, in Watts.

$EIRP$ = Equivalent Isotropically Radiated Power, in Watts.

G = Gain of the Transmitting Antenna.

R = Distance from the Transmitting Antenna, in meters.

B.7.3 Results

Power Density Calculation							
Mode	MCS	Frequency (GHz)	Average EIRP (dBm)	Average EIRP (W)	Separation Distance (m)	Power Density (W/m^2)	Limit (W/m^2)
WiGig	1	58.32	22.81	0.19	0.2	0.38	10
WiGig	1	60.48	26.24	0.42	0.2	0.84	10
WiGig	1	62.64	26.39	0.44	0.2	0.88	10