

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

Applicant: Sony Mobile Communications INC.

EUT Description: Mobile Phone

FCC ID: PY7-04605A

Report Number: ZR/2018/A001104

FCC Rule Part: §15.247, Cat: DTS

Issue Date: 2018/12/14

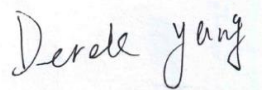
Date of Test: 2018/10/19 to 2018/11/14

Date of EUT Received: 2018/10/18

We hereby certify that:

The above equipment was tested by SGS Shenzhen Ltd. Electronics & Communication Laboratory. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits.

The test results of this report relate only to the tested sample identified in this report.

Authorized for issue by:		
Tested By		2018/12/14
	(Mike Hu) /Project Engineer	Date
Checked By		2018/12/14
	(David Chen) /Reviewer	Date
Approved By		2018/12/14
	(Derek Yang) Wireless Laboratory Manager	Date

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Revision History

Report Number	Revision	Description	Effected Page	Issue Date	Revised By
--	Rev.00	Initial creation of document	All	2018/11/28	--
--	Rev.01	Update the data rate as 1 Mbps , 2Mbps	Page 10	2018/12/14	--

The difference between PY7-04605A and PY7-50241M is show in the below table:

		PY7-04605A (Updated approval)	PY7-50241M (Full approval)
Licensed Frequency	LTE	1,2,3,5,7,8,28,38,39,40,41M	1,2,3,5,7,8,20,38
	UMTS	the same	the same
	GSM	the same	the same
	IC	the same	the same
	Antenna	the same	the same
Unlicensed Frequency	Bluetooth	The same	The same
	2.4G Wi-Fi	the same	the same
	5G Wi-Fi	the same	the same
	IC	the same	the same
	Antenna	the same	the same
Hardware	Ram / Rom	the same	the same
	Camera	The same	the same
	PCB	the same	the same
	USB Port	the same	the same
Appearance	Dimension	the same	the same
Accessory	Battery	the same	the same
	External Charger	the same	the same
	USB cable	the same	the same
other	SIM card	Double	Double

Considering to the difference, only the worst case RSE data was spot check and the data displayed in the report (Report No.: ZR/2018/A001106), the other data can refer to the original report (Report No.: ZR/2018/9002704)

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1 GENERAL INFORMATION

1.1 Product Description

General:

EUT Description:	Mobile Phone
Trade Mark:	Sony
Operation Frequency:	2402MHz~2480MHz $f_c = 2402 \text{ MHz} + N * 2 \text{ MHz}$, where: - f_c = "Operating Frequency" in MHz, - N = "Channel Number" with the range from 0 to 39.
Bluetooth Version:	Bluetooth V5.0
Modulation Type:	GFSK
Number of Channel:	40
Sample Type:	☒ Portable Device, ☐ Module
Antenna Type:	☐ External, ☒ Integrated
Antenna Gain:	-2.79dBi
Power Supply:	Lithium-ion battery:3.85V or charge by USB

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1.2 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247

FCC KDB 558074 D01 DTS Meas. Guidance v05.

ANSI C63.10:2013

Note: All test items have been performed and record as per the above standards.

1.3 Test Facility

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

• CNAS (No. CNAS L2929)

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

• A2LA (Certificate No. 3816.01)

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

• VCCI

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

• FCC –Designation Number: CN1178

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

• Industry Canada (IC)

Two 3m Semi-anechoic chambers and the 10m Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1, 4620C-2, 4620C-3.

1.4 Special Accessories

AC Charger, USB cable and Earphone are used while the test is conducted and there is no other accessory attached. This is the worst case condition.

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commission's requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is placed on a table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz. The CISPR Quasi-Peak and Average detector mode is employed according to §15.207. The two LISNs provide 50 ohm/ 50 uH of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

2.3.2 Conducted Test (RF)

The active antenna port of the unlicensed wireless device is connected to the spectrum analyzer with attenuator to protect the instrumentation. If a second antenna port is available, it is tested at one operating frequency, with other port(s) appropriately terminated, to verify it has similar output characteristics as the fully tested port.

2.3.3 Radiated Emissions

The EUT is placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "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." is still within the 3dB illumination BW of the measurement antenna.

2.4 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

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2.5 Configuration of Tested System

Fig. 2-1 Conducted Emission Configuration

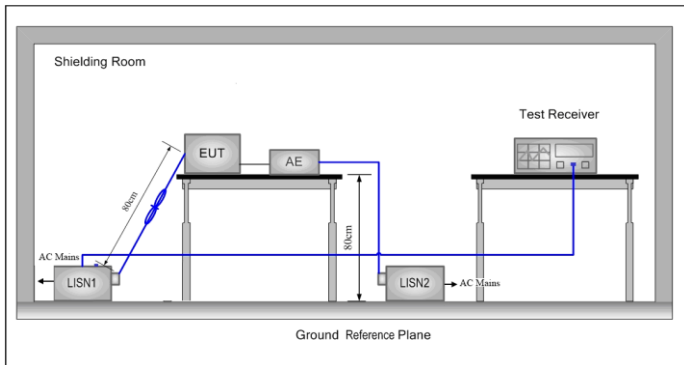


Fig. 2-2 Conducted Test Configuration(RF)

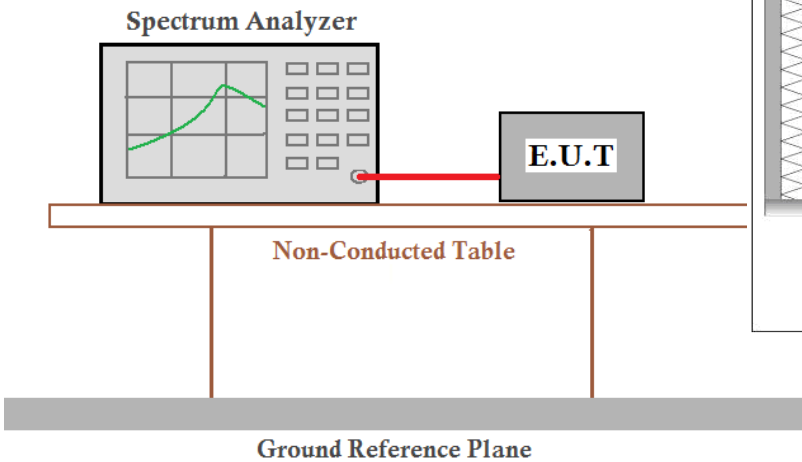


Fig. 2-3 Conducted power Configuration

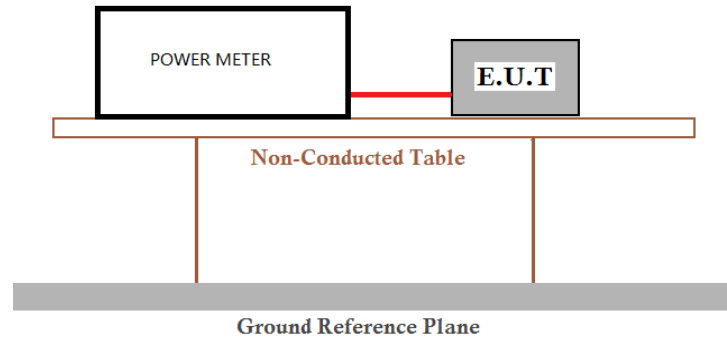
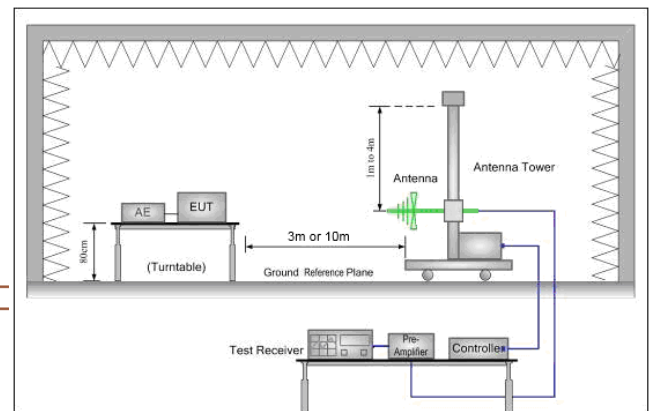
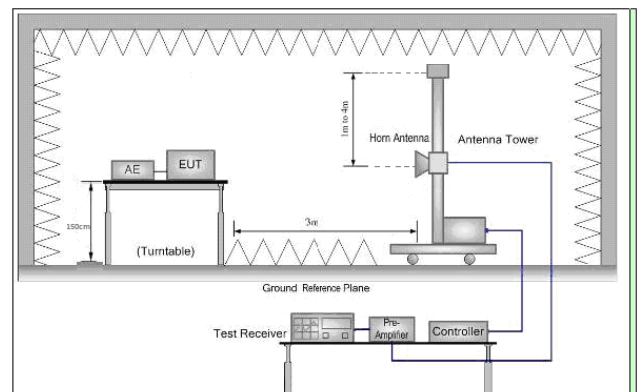


Fig. 2-4 Radiated Emission Configuration



30MHz to 1GHz



Above 1 GHz

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3 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	AC Power Line Conducted Emission	Compliant
§15.247(b) (3)	Peak Output Power	Compliant
§15.247(a)(2)	6dB Bandwidth	Compliant
§15.247(d)	Conducted Band Edge and Spurious Emission	Compliant
§15.247(d)	Radiated Band Edge and Spurious Emission	Compliant
§15.247(e)	Peak Power Density	Compliant
§15.203 §15.247(b)	Antenna Requirement	Compliant

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4 DESCRIPTION OF TEST MODES

4.1 Operated in 2400 ~ 2483.5MHz Band

40 channels are provided for Bluetooth LE

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
0	2402 MHz	14	2430 MHz	28	2458 MHz
1	2404 MHz	15	2432 MHz	39	2460 MHz
2	2406 MHz	16	2434 MHz	30	2462 MHz
3	2408 MHz	17	2436 MHz	31	2464 MHz
4	2410 MHz	18	2438 MHz	32	2466 MHz
5	2412 MHz	19	2440 MHz	33	2468 MHz
6	2414 MHz	20	2442 MHz	34	2470 MHz
7	2416MHz	21	2444 MHz	35	2472 MHz
8	2418 MHz	22	2446 MHz	36	2474 MHz
9	2420 MHz	23	2448 MHz	37	2476 MHz
10	2422 MHz	24	2450 MHz	38	2478 MHz
11	2424 MHz	25	2452 MHz	39	2480 MHz
12	2426 MHz	26	2454 MHz		
13	2428 MHz	27	2456 MHz		

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4.2 The Worst Test Modes and Channel Details

1. The EUT has been tested under operating condition.
2. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

4.2.1 RADIATED EMISSION TEST:

MODE	AVAILABLE FREQUENCY (MHz)	TESTED FREQUENCY (MHz)	MODULATION	DATA RATE (Mbps)
RADIATED EMISSION TEST (BELOW 1 GHz)				
Bluetooth LE	2402 to 2480	2402, 2440, 2480	GFSK	1 Mbps, 2Mbps
RADIATED EMISSION TEST (ABOVE 1 GHz)				
Bluetooth LE	2402 to 2480	2402, 2440, 2480	GFSK	1 Mbps, 2Mbps

4.2.2 ANTENNA PORT CONDUCTED MEASUREMENT:

CONDUCTED TEST				
MODE	AVAILABLE FREQUENCY (MHz)	TESTED FREQUENCY (MHz)	MODULATION	DATA RATE (Mbps)
Bluetooth LE	2402 to 2480	2402, 2440, 2480	GFSK	1 Mbps, 2Mbps

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5 MEASUREMENT UNCERTAINTY

No.	Item	Measurement Uncertainty
1	Total RF power, conducted	$\pm 0.75\text{dB}$
2	RF power density, conducted	$\pm 2.84\text{dB}$
3	Spurious emissions, conducted	$\pm 0.75\text{dB}$
4	Radiated Spurious emission test	$\pm 4.5\text{dB}$ (30MHz-1GHz)
		$\pm 4.8\text{dB}$ (1GHz-25GHz)
5	Conduct emission test	$\pm 3.12\text{ dB}$ (9KHz- 30MHz)
6	Temperature test	$\pm 1^{\circ}\text{C}$
7	Humidity test	$\pm 3\%$
8	DC and low frequency voltages	$\pm 0.5\%$

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

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6 CONDUCTED EMISSION TEST

6.1 Standard Applicable:

Frequency range within 150kHz to 30MHz shall not exceed the Limit table as below.

Frequency range MHz	Limits dB(μV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Note

1.The lower limit shall apply at the transition frequencies

2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

6.2 Measurement Equipment Used:

Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date	Cal.Duedate
				(yyyy-mm-dd)	(yyyy-mm-dd)
Shielding Room	ZhongYu Electron	GB-88	SEM001-06	2017/5/10	2020/5/9
LISN	Rohde & Schwarz	ENV216	SEM007-01	2018/9/2	2019/9/2
LISN	ETS-LINDGREN	Feb-16	SEM007-02	2018/4/2	2019/4/1
Measurement Software	AUDIX	e3 V5.4.1221d	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM024-01	2018/7/12	2019/7/11
2 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN-T2-02	EMC0122	2018/2/14	2019/2/13
EMI Test Receiver	Rohde & Schwarz	ESCI	SEM004-02	2018/4/2	2019/4/1

6.3 EUT Setup:

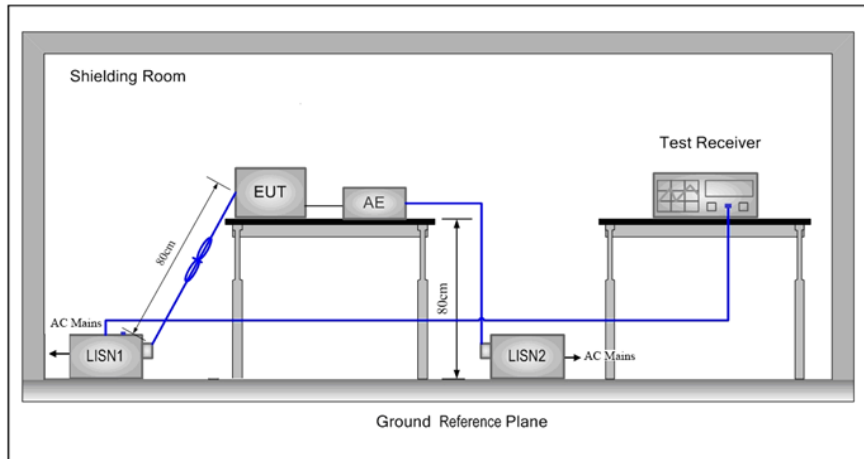
1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

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6.4 Test SET-UP (Block Diagram of Configuration)



6.5 Measurement Procedure:

1. The EUT was placed on a table which is 0.8m above ground plan.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all phases of power being supplied by given UE are completed

6.6 Measurement Result:

Note: Refer to next page for measurement data and plots.

Note2: The * reveals the worst-case results that closet to the limit.

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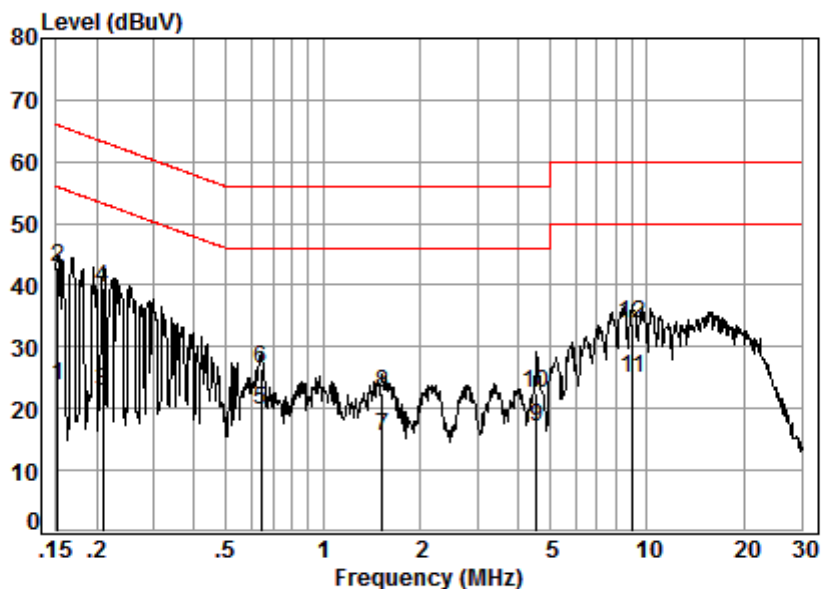
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AC POWER LINE CONDUCTED EMISSION TEST DATA : L



Site : Shielding Room

Condition: Line

Job No. : 90027

Test mode: c

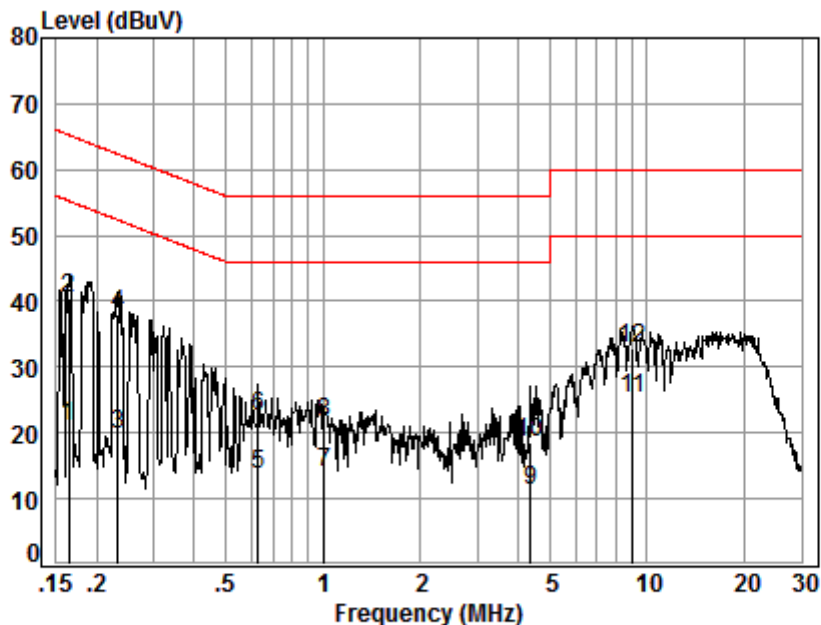
	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.15	0.01	9.66	14.18	23.85	55.91	-32.06	Average
2	0.15	0.01	9.66	33.23	42.90	65.91	-23.01	QP
3	0.21	0.02	9.66	13.27	22.95	53.23	-30.28	Average
4	0.21	0.02	9.66	29.89	39.57	63.23	-23.66	QP
5	0.64	0.07	9.67	10.17	19.91	46.00	-26.09	Average
6	0.64	0.07	9.67	16.60	26.34	56.00	-29.66	QP
7	1.53	0.13	9.73	5.71	15.57	46.00	-30.43	Average
8	1.53	0.13	9.73	12.67	22.53	56.00	-33.47	QP
9	4.57	0.17	9.73	7.24	17.14	46.00	-28.86	Average
10	4.57	0.17	9.73	12.51	22.41	56.00	-33.59	QP
11	9.01	0.17	9.83	15.05	25.05	50.00	-24.95	Average
12	9.01	0.17	9.83	23.76	33.76	60.00	-26.24	QP

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AC POWER LINE CONDUCTED EMISSION TEST DATA : N



Site : Shielding Room

Condition: Neutral

Job No. : 90027

Test mode: c

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.16	0.01	9.64	11.31	20.96	55.25	-34.29	Average
2	0.16	0.01	9.64	30.94	40.59	65.25	-24.66	QP
3	0.23	0.03	9.64	10.05	19.72	52.35	-32.63	Average
4	0.23	0.03	9.64	28.28	37.95	62.35	-24.40	QP
5	0.63	0.07	9.64	4.04	13.75	46.00	-32.25	Average
6	0.63	0.07	9.64	12.83	22.54	56.00	-33.46	QP
7	1.00	0.09	9.71	4.18	13.98	46.00	-32.02	Average
8	1.00	0.09	9.71	11.67	21.47	56.00	-34.53	QP
9	4.38	0.16	9.70	1.34	11.20	46.00	-34.80	Average
10	4.38	0.16	9.70	8.69	18.55	56.00	-37.45	QP
11	9.01	0.17	9.82	15.20	25.19	50.00	-24.81	Average
12	9.01	0.17	9.82	22.97	32.96	60.00	-27.04	QP

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7 CONDUCTED OUTPUT POWER MEASUREMENT

7.1 Standard Applicable:

For systems using digital modulation in the 2400-2483.5 MHz bands, the limit for peak output power is 1Watt.

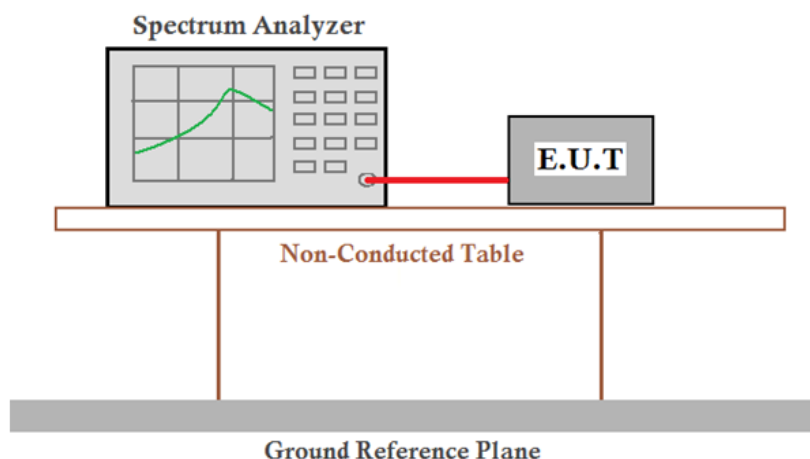
If the transmitting antenna of directional gain greater than 6dBi are used the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the Antenna exceeds 6dBi.

In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of Antenna exceeds 6dBi.

7.2 Measurement Equipment Used:

Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date	Cal.Duedate
				(yyyy-mm-dd)	(yyyy-mm-dd)
DC Power Supply	Agilent Technologies Inc.	66311B	W009-09	2018/9/15	2019/9/15
Signal Analyzer	Rohde & Schwarz	FSV	W025-05	2018/3/13	2019/3/12
Coaxial Cable	SGS	N/A	SEM031-01	2018/7/13	2019/7/12
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2018/9/2	2019/9/2
Temperature Chamber	GIANT FORCE	TC-150-40-CP-AD	W027-03	2018/11/27	2019/11/27
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2018/9/2	2019/9/2

7.3 Test Set-up:



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7.4 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.

Power Meter:

It is used as the auxiliary test equipment to conduct the output power measurement.

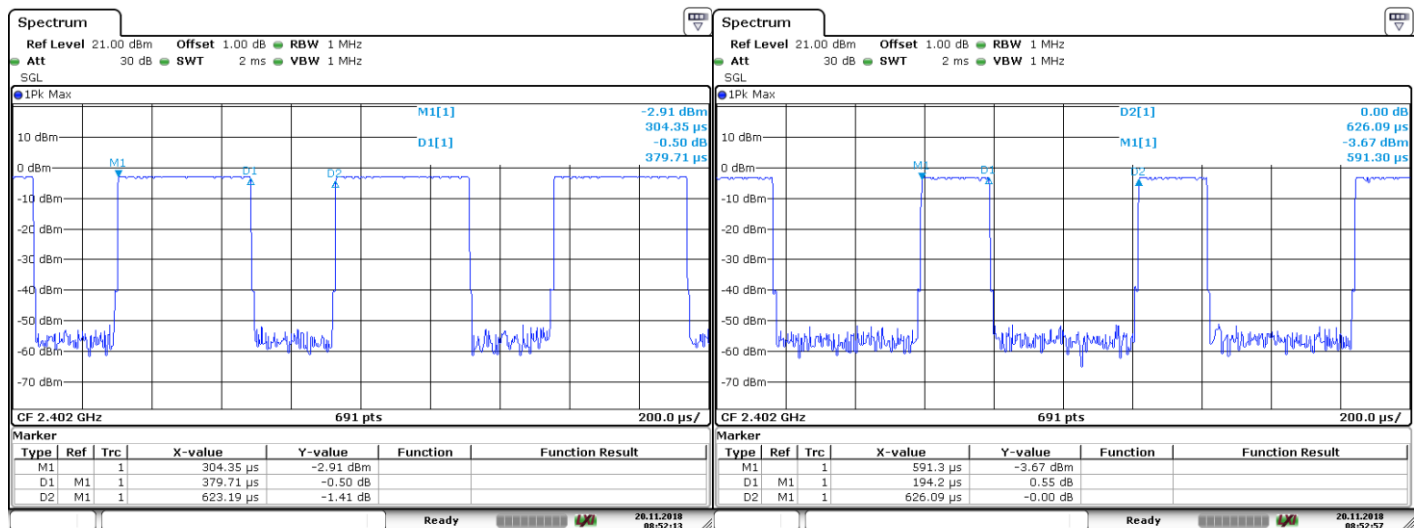
4. Record the max. Reading as observed from Power Meter.
5. Repeat above procedures until all test default channel measured was complete.

Formula:

Duty Cycle = Ton / (Ton+Toff)

Duty Factor (1M) : $10 \cdot \log(1/0.609) = 2.15$

Duty Factor (2M) : $10 \cdot \log(1/0.31) = 5.08$



Date: 20 NOV. 2018 08:52:14

Date: 20 NOV. 2018 08:52:58

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7.5 Measurement Result:

7.5.1 Measurement Data of Average Power

GFSK 1M mode		
Test channel	Average Output Power (dBm)	Result
Lowest	-5.37	Report purpose only
Middle	-4.30	Report purpose only
Highest	-5.14	Report purpose only

GFSK 2M mode		
Test channel	Average Output Power (dBm)	Result
Lowest	-8.01	Report purpose only
Middle	-7.08	Report purpose only
Highest	-7.92	Report purpose only

7.5.2 Measurement Data of Peak Power

GFSK 1M mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	-2.66	30.00	Pass
Middle	-1.78	30.00	Pass
Highest	-2.81	30.00	Pass

GFSK 2M mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	-2.71	30.00	Pass
Middle	-1.81	30.00	Pass
Highest	-2.85	30.00	Pass

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8 6DB & 99% EMISSION BANDWIDTH MEASUREMENT

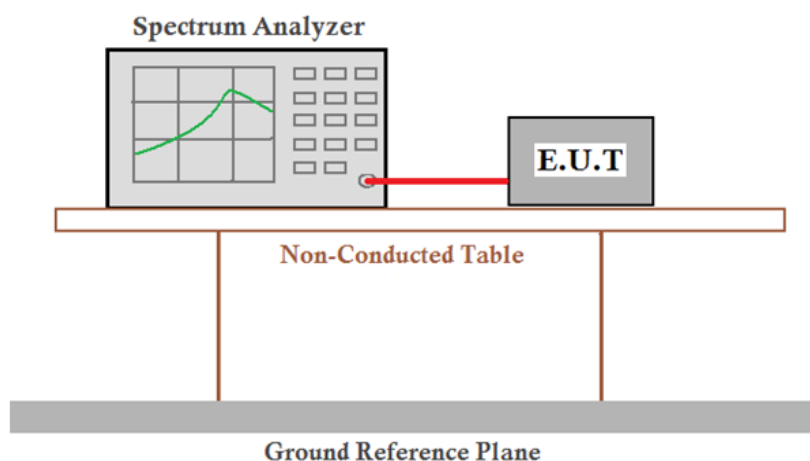
8.1 Standard Applicable

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

8.2 Measurement Equipment Used

Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date	Cal.Duedate
				(yyyy-mm-dd)	(yyyy-mm-dd)
DC Power Supply	Agilent Technologies Inc	66311B	W009-09	2018/9/15	2019/9/15
Signal Analyzer	Rohde & Schwarz	FSV	W025-05	2018/3/13	2019/3/12
Coaxial Cable	SGS	N/A	SEM031-01	2018/7/13	2019/7/12
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2018/9/2	2019/9/2
Temperature Chamber	GIANT FORCE	TC-150-40-CP-AD	W027-03	2018/11/27	2019/11/27
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2018/9/2	2019/9/2

8.3 Test Set-up:



8.4 Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. For 6dB Bandwidth:
Set the spectrum analyzer as RBW=100 kHz, VBW= 3*RBW, Span = 3MHz, Detector=Peak, Sweep=auto.
5. Mark the peak frequency and -6dB (upper and lower) frequency.
6. For 99% Bandwidth:

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Set the spectrum analyzer as RBW=100 kHz, VBW= 3*RBW, Span = 3MHz, Detector=Peak, Sweep=auto.

7. Turn on the 99% bandwidth function, max reading.

8. Repeat above procedures until all test default channel is completed

8.5 Measurement Result:

Mode	Test Channel	Occupied Bandwidth (kHz)	6dB Emission Bandwidth (kHz)	Limit (kHz)	Result
GFSK 1M	Lowest	1054.9	707.3	≥500	Pass
	Middle	1054.9	716.3	≥500	Pass
	Highest	1054.9	716.3	≥500	Pass

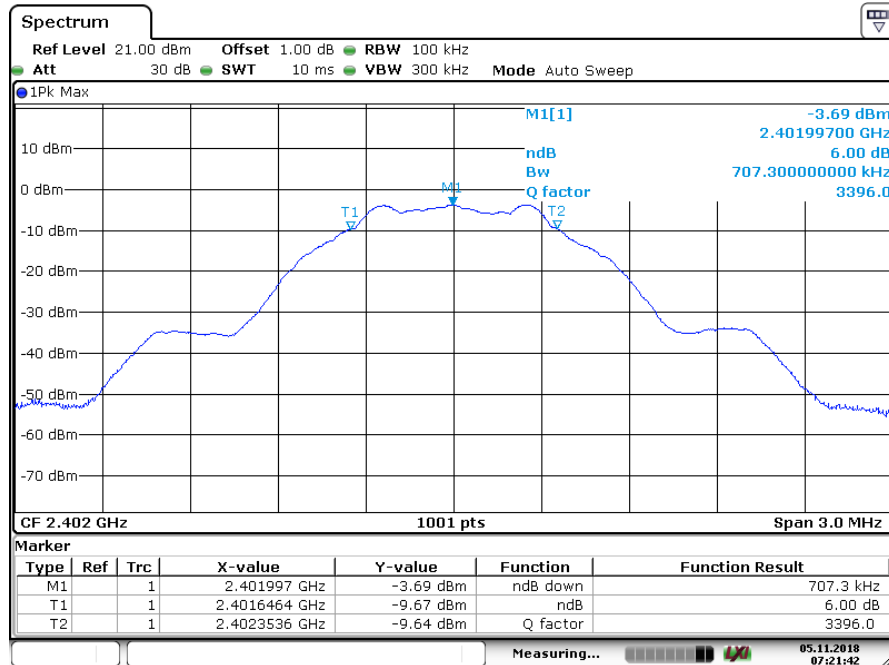
Mode	Test Channel	Occupied Bandwidth (kHz)	6dB Emission Bandwidth (kHz)	Limit (kHz)	Result
GFSK 2M	Lowest	2073.9	1180.8	≥500	Pass
	Middle	2079.9	1180.8	≥500	Pass
	Highest	2079.9	1180.8	≥500	Pass

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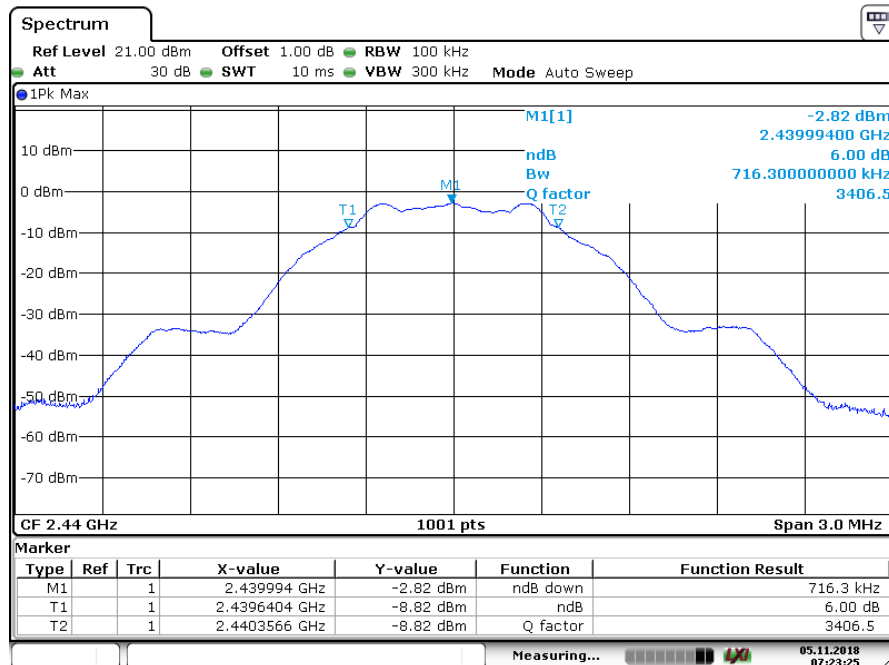
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8.5.1 6dB Bandwidth Test Data 1M Mode CH-Low



Date: 5 NOV 2018 07:21:43

8.5.2 6dB Bandwidth Test Data 1M Mode CH-Mid



Date: 5 NOV 2018 07:23:25

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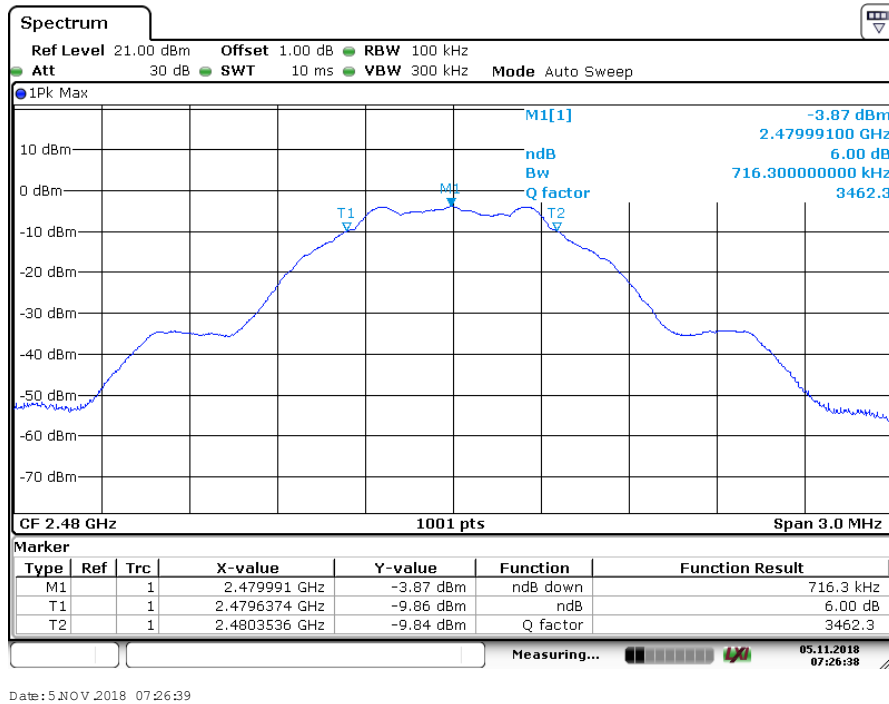
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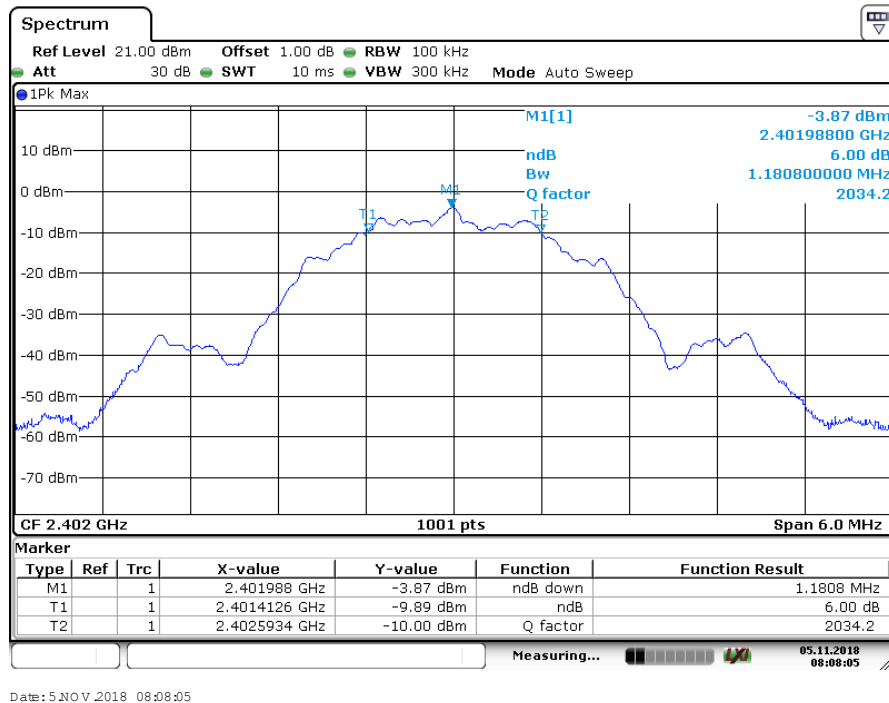
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8.5.3 6dB Bandwidth Test Data 1M Mode CH-High



8.5.4 6dB Bandwidth Test Data 2M Mode CH-Low

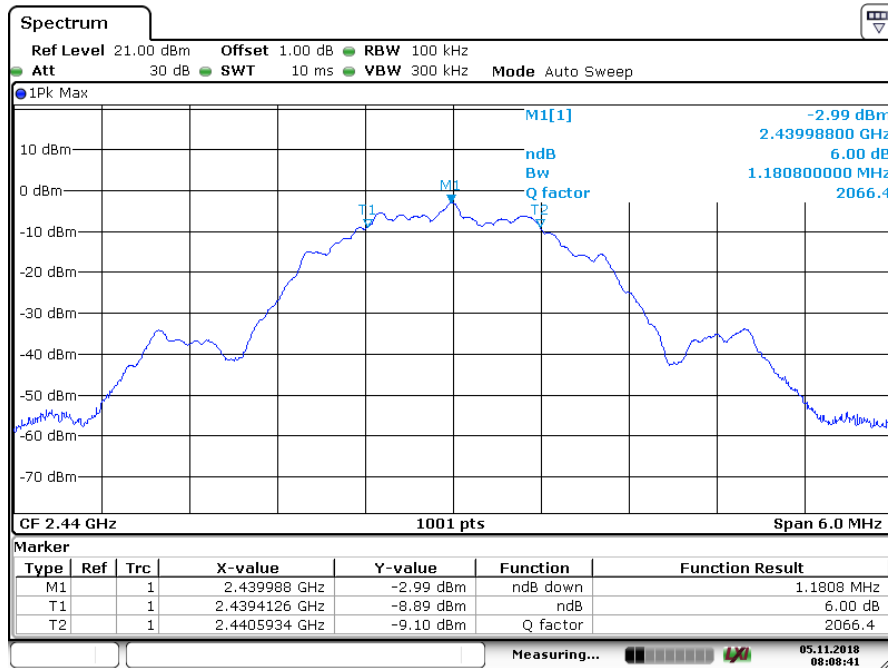


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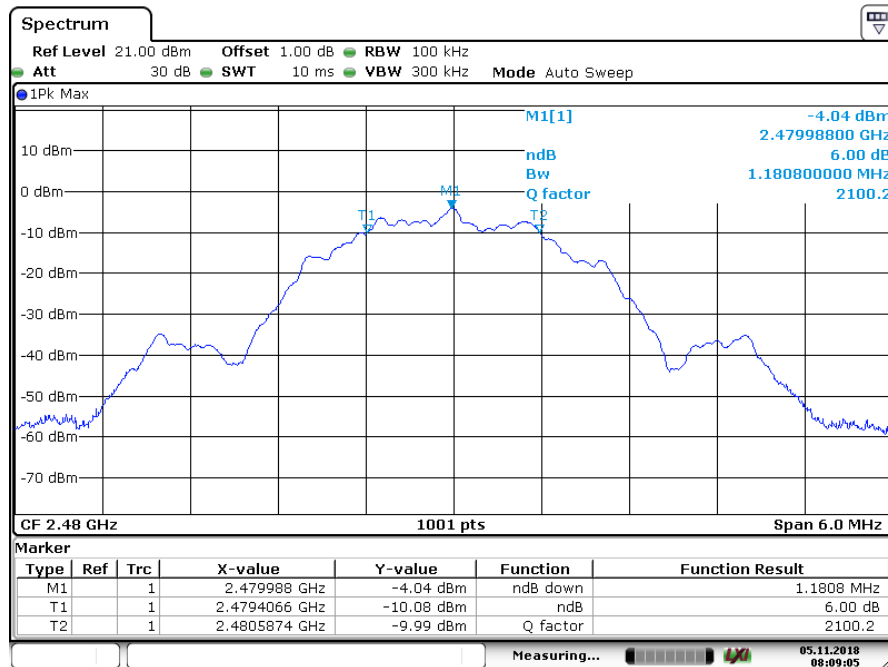
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8.5.5 6dB Bandwidth Test Data 2M Mode CH-Mid



Date: 5 NOV 2018 08:08:42

8.5.6 6dB Band Width Test Data 2M Mode CH-High



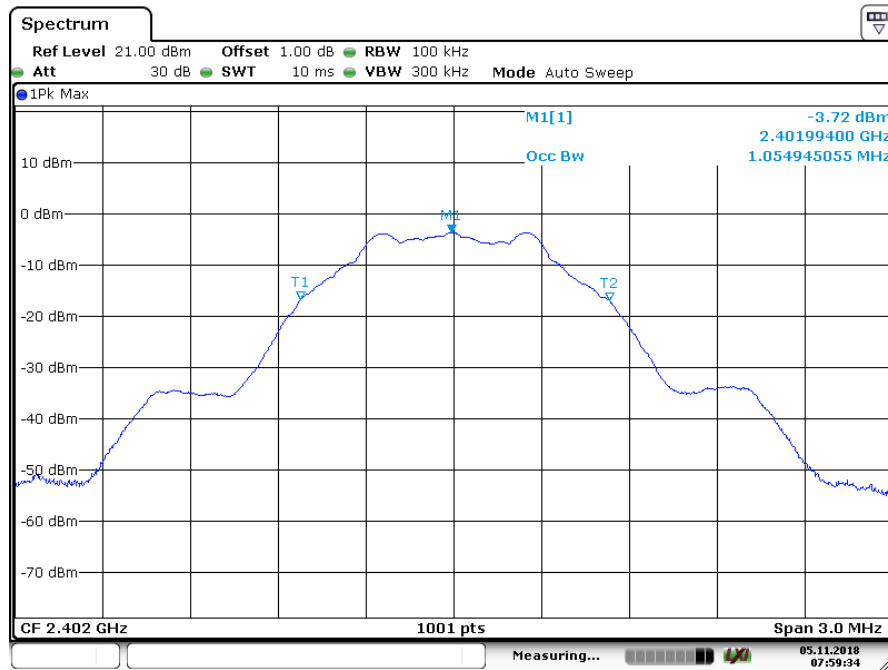
Date: 5 NOV 2018 08:09:05

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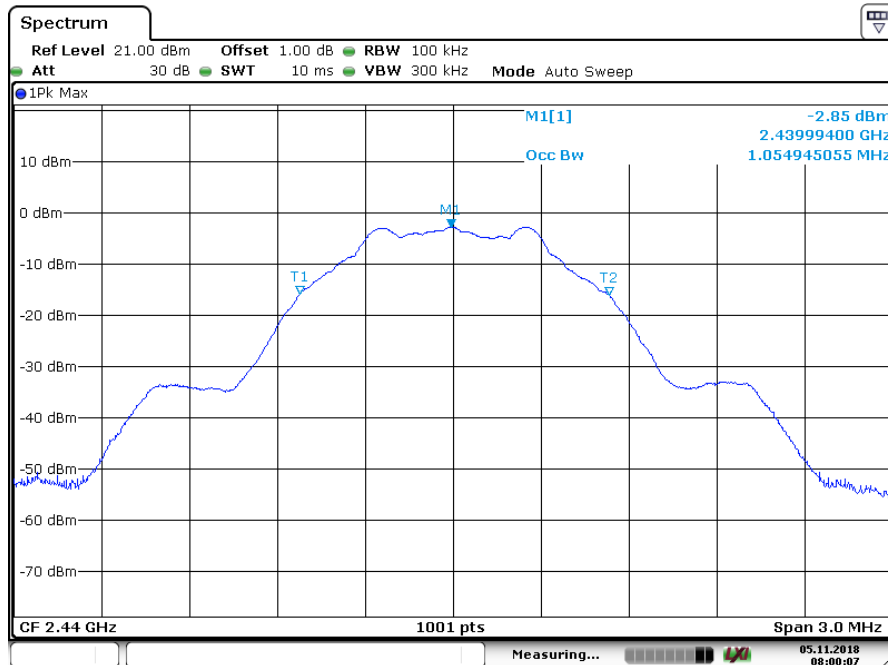
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8.5.7 OBW Bandwidth Test Data 1M Mode CH-Low



Date: 5 NOV 2018 07:59:34

8.5.8 OBW Bandwidth Test Data 1M Mode CH-Mid



Date: 5 NOV 2018 08:00:07

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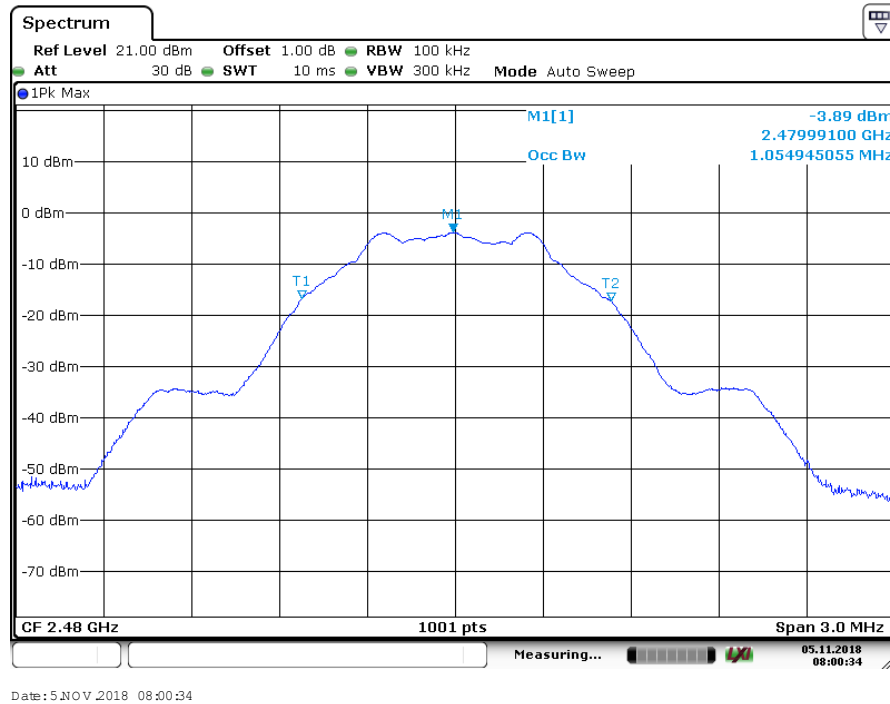
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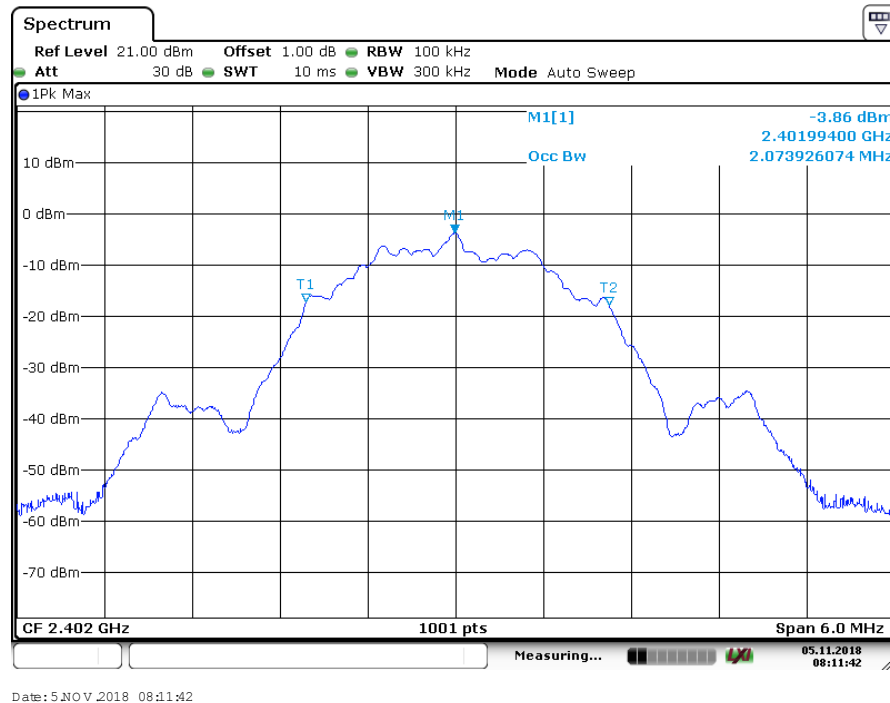
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8.5.9 OBW Bandwidth Test Data 1M Mode CH-High



8.5.10 OBW Bandwidth Test Data 2M Mode CH-Low

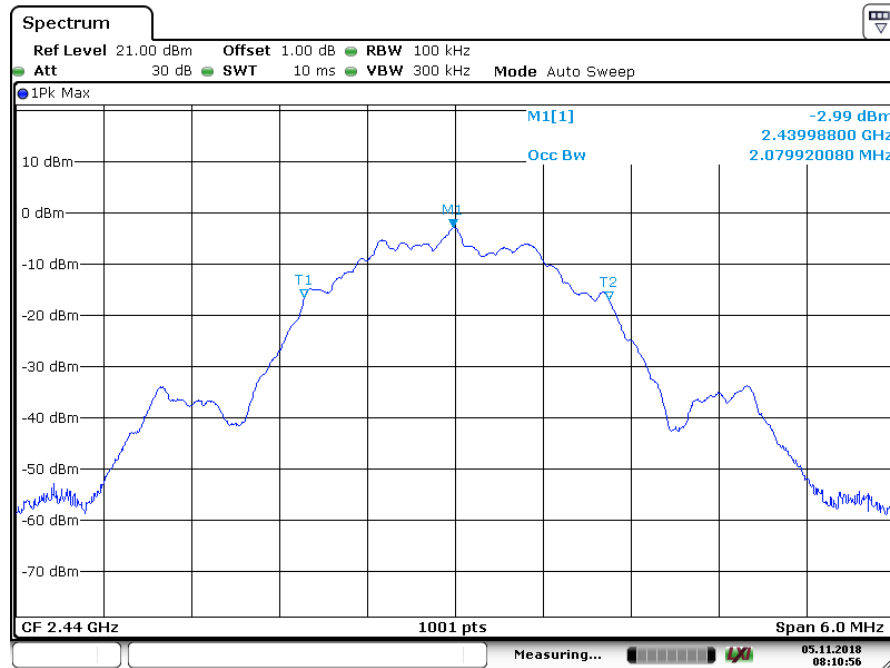


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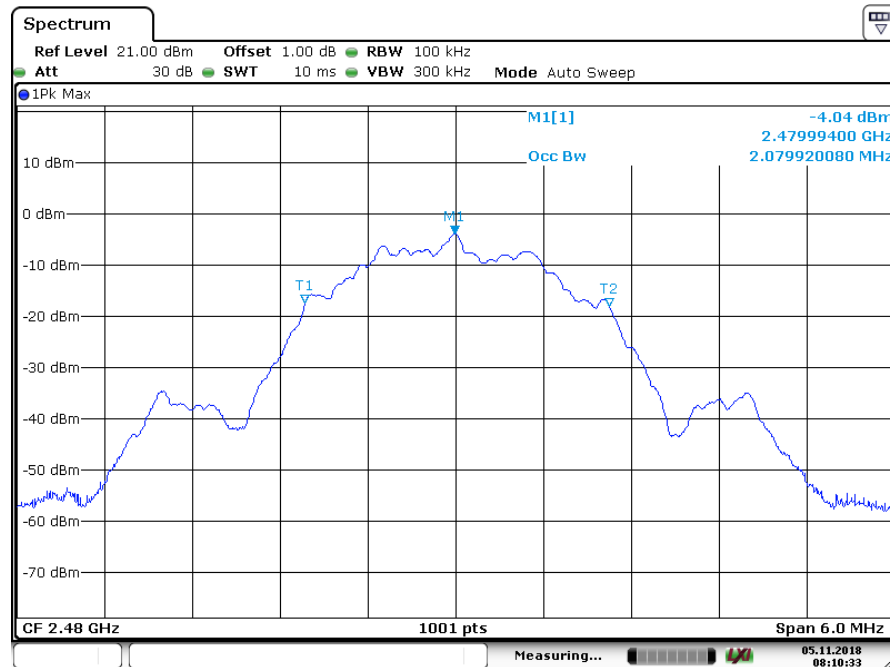
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8.5.11 OBW Bandwidth Test Data 2M Mode CH-Mid



Date: 5 NOV 2018 08:10:57

8.5.12 OBW Bandwidth Test Data 2M Mode CH-High



Date: 5 NOV 2018 08:10:33

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9 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

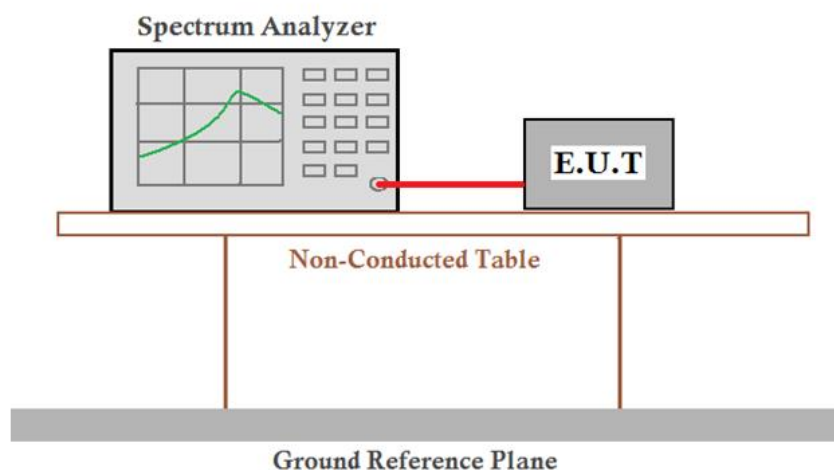
9.1 Standard Applicable

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. 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).

9.2 Measurement Equipment Used:

Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date	Cal.Duedate
				(yyyy-mm-dd)	(yyyy-mm-dd)
DC Power Supply	Agilent Technologies Inc	66311B	W009-09	2018/9/15	2019/9/15
Signal Analyzer	Rohde & Schwarz	FSV	W025-05	2018/3/13	2019/3/12
Coaxial Cable	SGS	N/A	SEM031-01	2018/7/13	2019/7/12
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2018/9/2	2019/9/2
Temperature Chamber	GIANT FORCE	ICT-150-40-CT-AD	W027-03	2018/11/27	2019/11/27
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2018/9/2	2019/9/2

9.3 Test SET-UP:



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9.4 Measurement Procedure

Conducted Band Edge:

1. To connect Antenna Port of EUT to Spectrum.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set start to edge frequency, and stop frequency of spectrum analyzer so as to encompass the spectrum to be examined.
5. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Detector = Peak, Sweep = auto
6. Mark the highest reading of the emission as the reference level measurement.
7. Marker on frequency and examine shall 100 kHz immediately outside the authorized (2400~2483.5MHz) be attenuated by 20dB at least relative to the maximum emission of power.
8. Repeat above procedures until all default test channel (low, middle, and high) was complete.

Conducted Spurious Emission

1. To connect Antenna Port of EUT to Spectrum.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Set RBW = 100 kHz & VBW=300 kHz, Detector =Peak, Sweep = Auto
4. Allow trace to fully stabilize.
5. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
6. Repeat above procedures until all default test channel measured were complete.

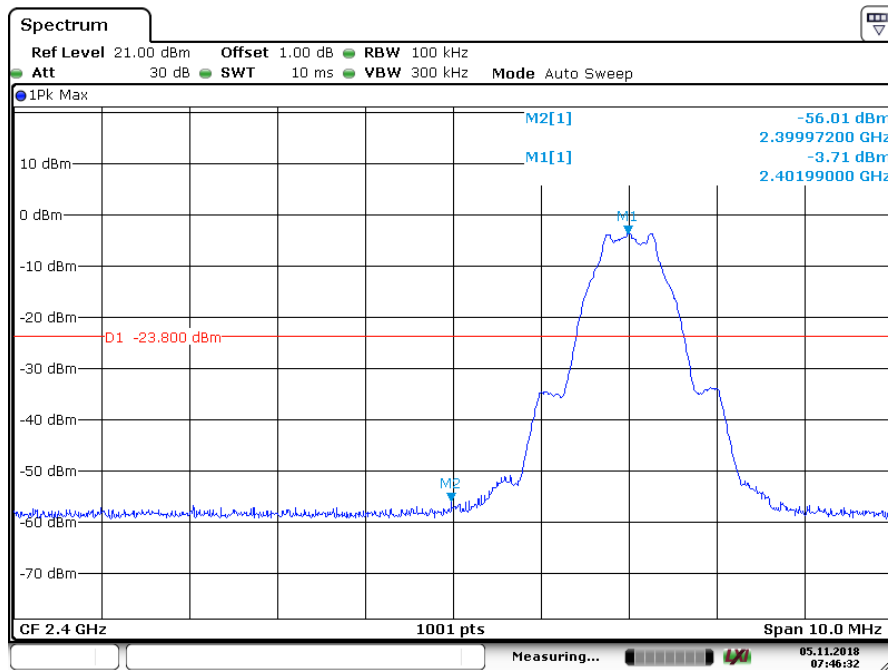
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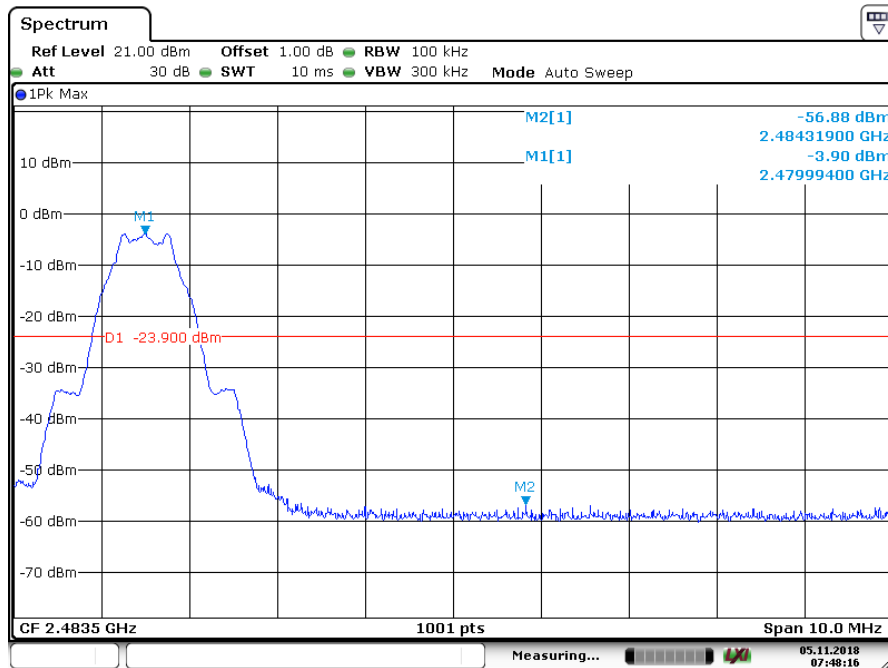
9.5 Measurement Result

9.5.1 Band Edge Test Data 1M Mode CH-Low



Date: 5 NOV 2018 07:46:32

9.5.2 Band Edge Test Data 1M Mode CH-High



Date: 5 NOV 2018 07:48:17

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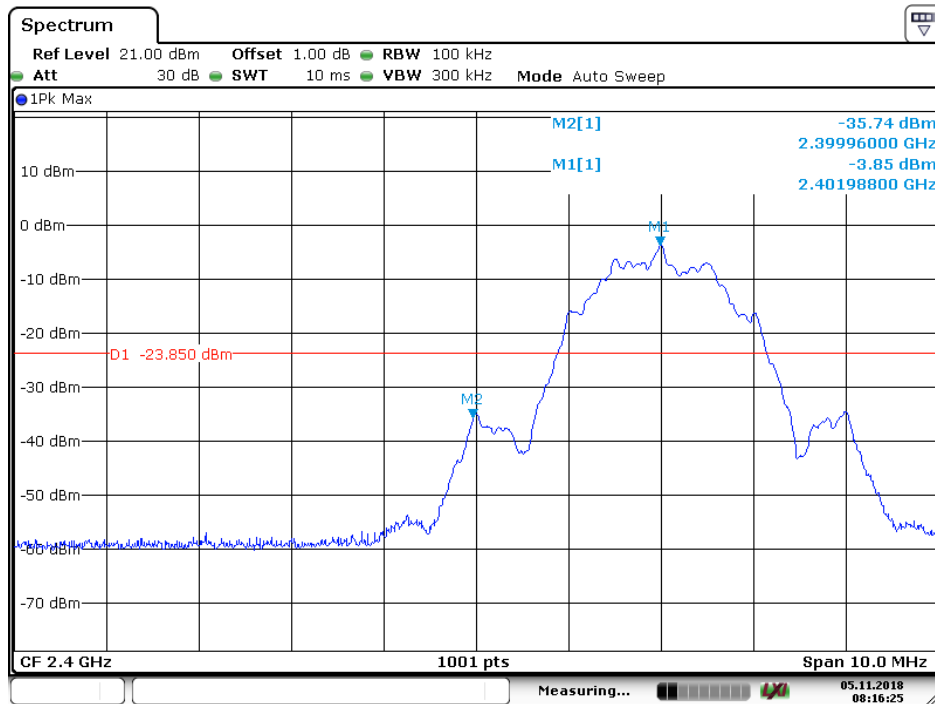
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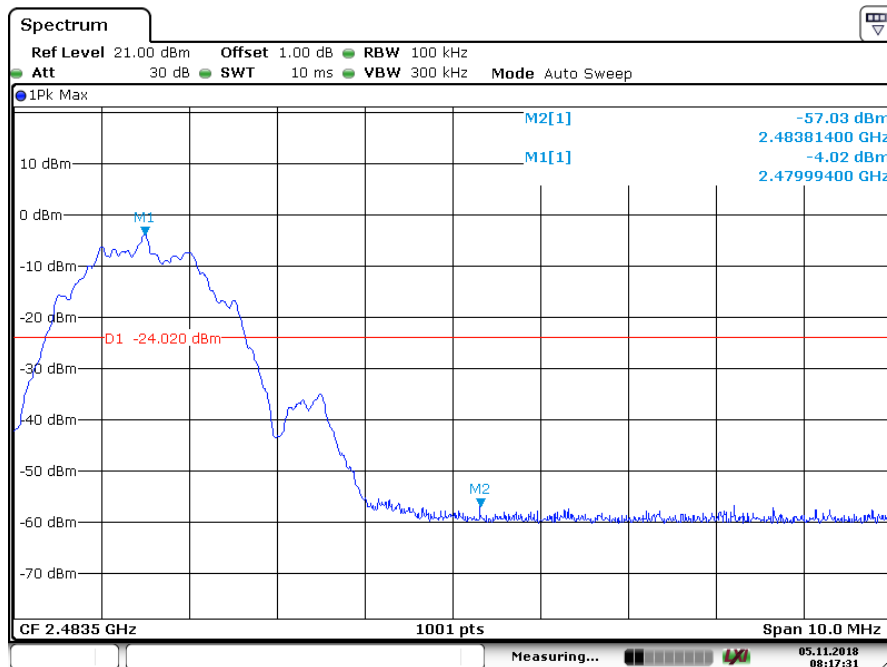
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9.5.3 Band Edge Test Data 2M Mode CH-Low



Date: 5 NOV 2018 08:16:25

9.5.4 Band Edge Test Data 2M Mode CH-High



Date: 5 NOV 2018 08:17:31

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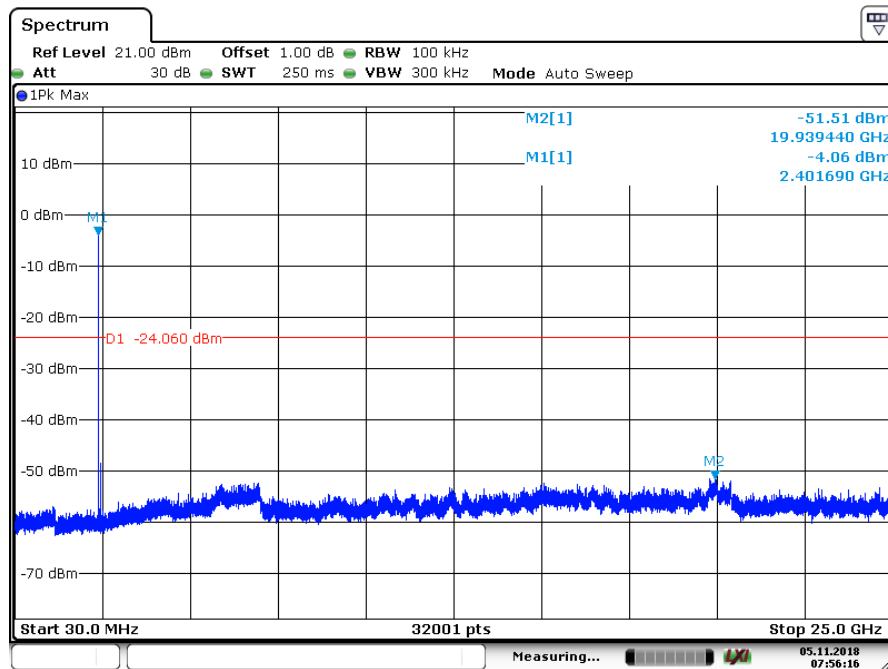
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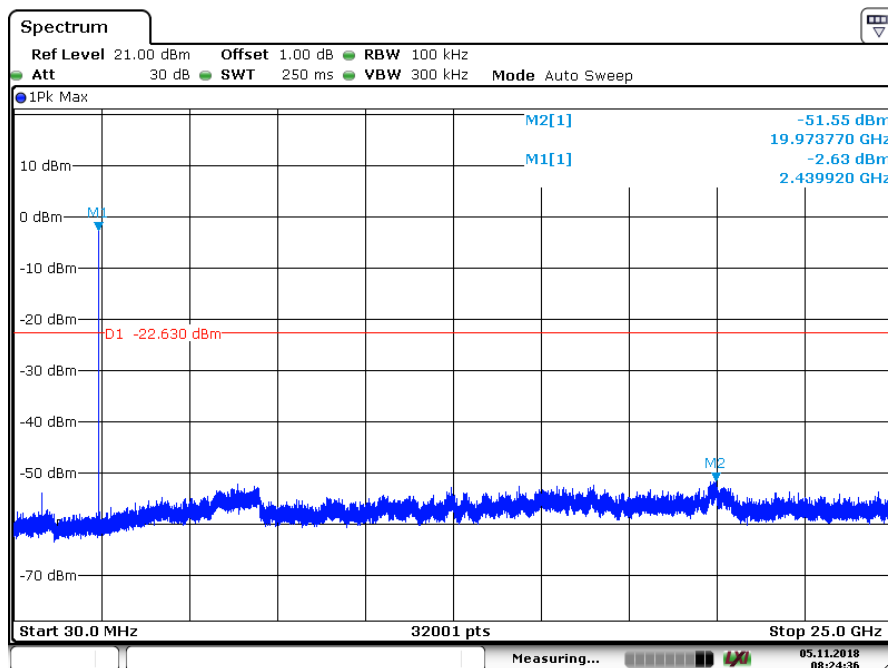
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9.5.5 Conducted Emission Test Data 1M Mode CH-Low



Date: 5 NOV 2018 07:56:17

9.5.6 Conducted Emission Test Data 1M Mode CH-Mid



Date: 5 NOV 2018 08:24:37

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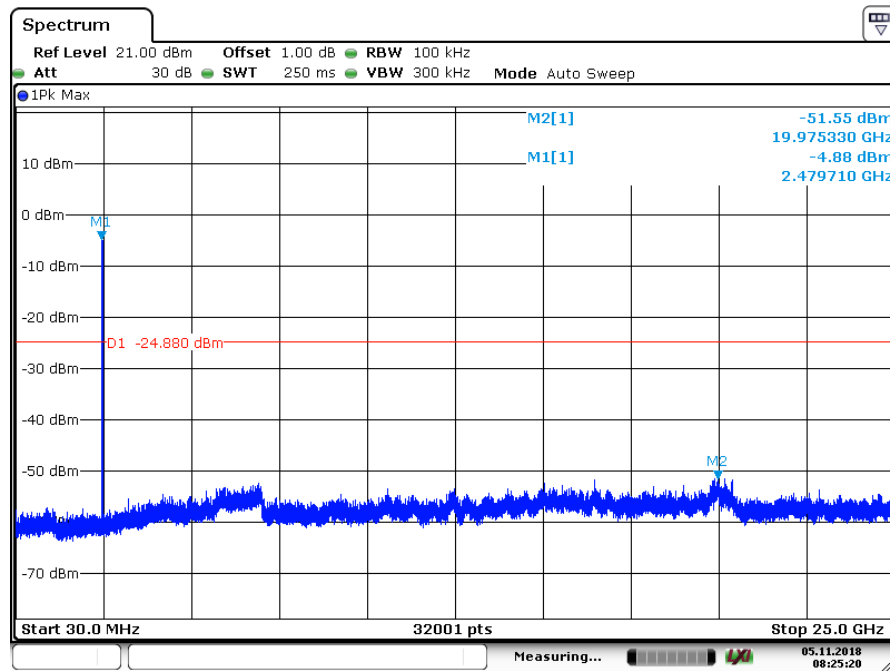
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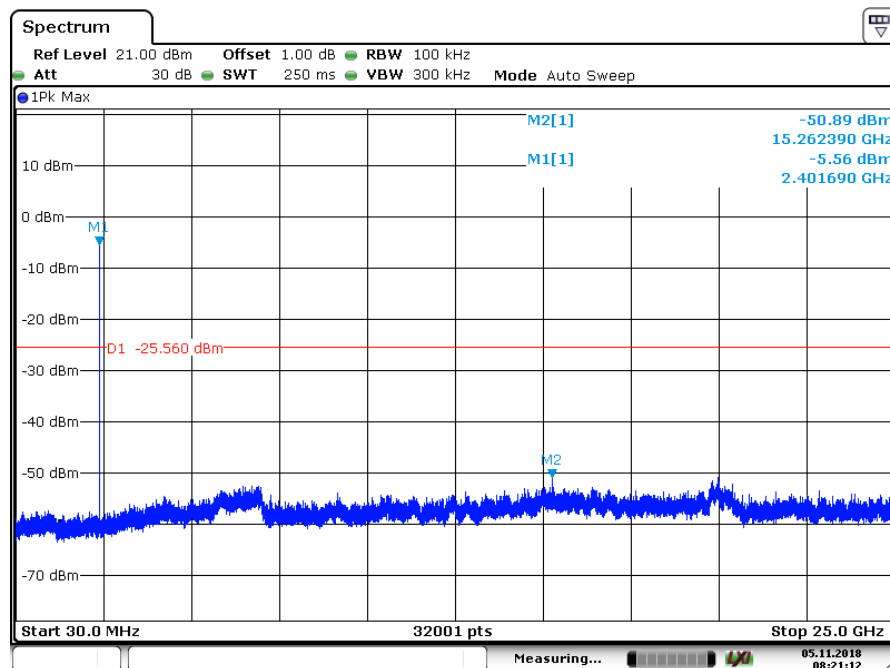
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9.5.7 Conducted Emission Test Data 1M Mode CH-High



Date: 5 NOV 2018 08:25:21

9.5.8 Conducted Emission Test Data 2M Mode CH-Low



Date: 5 NOV 2018 08:21:12

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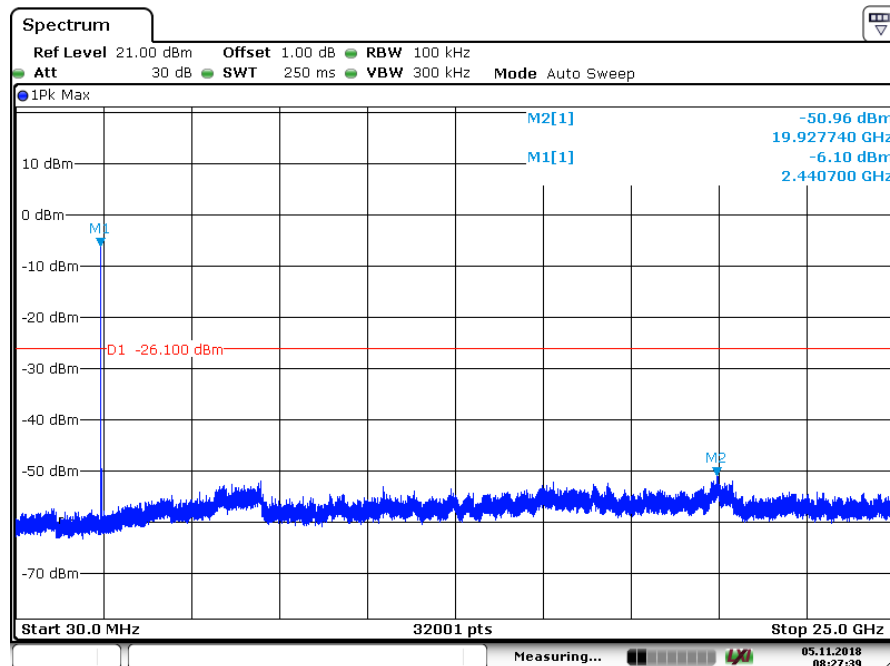
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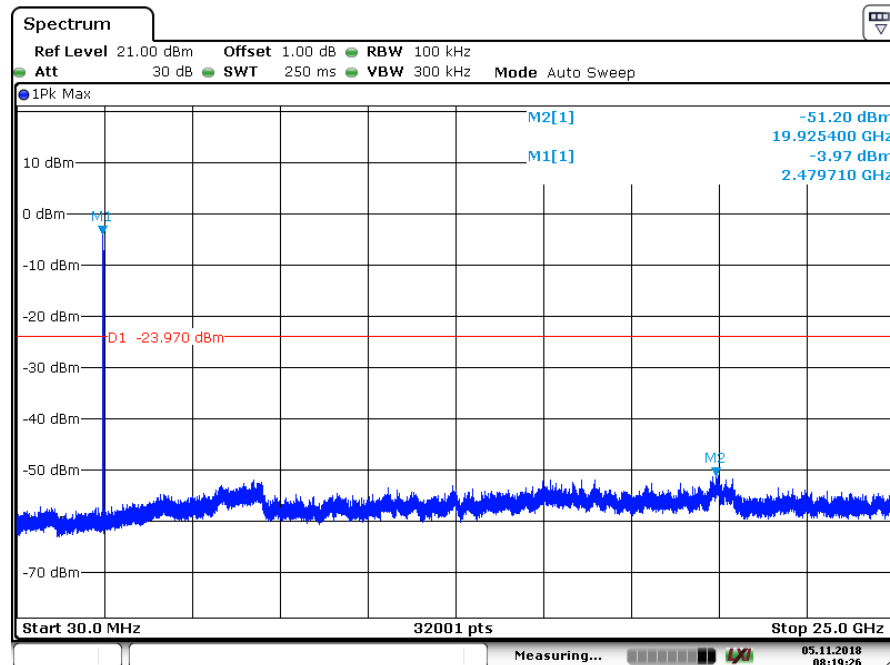
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9.5.9 Conducted Emission Test Data 2M Mode CH-Mid



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9.5.10 Conducted Emission Test Data 2M Mode CH-High



Date: 5 NOV. 2018 08:19:27

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10 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

10.1 Standard Applicable

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. In addition, radiated emissions which fall in the restricted bands must also comply with the §15.209 limit as below.

And according to §15.33(a) (1), for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

Frequency (MHz)	Field strength (microvolts/meter)	Distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBμV/m) = 20 log Emission level (dBμV/m)

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10.2 Measurement Equipment Used

RE in Chamber					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy-mm-dd)	Cal.Due date (yyyy-mm-dd)
3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2017/8/5	2020/8/4
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM025-01	2018/7/12	2019/7/11
MXE EMI Receiver (20Hz-8.4GHz)	Agilent Technologies	N9038A	SEM004-05	2018/9/2	2019/9/2
BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEM003-01	2017/6/27	2020/6/26
Pre-amplifier (0.1-1.3GHz)	Agilent Technologies	8447D	SEM005-01	2018/4/2	2019/4/1

RE in Chamber					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date (yyyy-mm-dd)	Cal. Due date (yyyy-mm-dd)
10m Semi-Anechoic Chamber	SAEMC	FSAC1018	SEM001-03	2018/3/31	2021/3/30
EMI Test Receiver (9K-7GHz)	Rohde & Schwarz	ESR	SEM004-03	2018/4/2	2019/4/1
Trilog-Broadband Antenna(25M-2GHz)	Schwarzbeck	VULB9168	SEM003-18	2016/6/29	2019/6/28
Pre-amplifier (9K-1GHz)	Sonoma	310N	SEM005-03	2018/4/13	2019/4/12
Loop Antenna (9KHz-20MHz)	ETS-Lindgren	6502	SEM003-08	2017/8/22	2020/8/21
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM029-01	2018/7/12	2019/7/11

RE in Chamber					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy-mm-dd)	Cal.Due date (yyyy-mm-dd)
3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2018/3/13	2021/3/12
Measurement Software	AUDIX	e3V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM026-01	2018/7/12	2019/7/11
EXA Signal Analyzer (10Hz-26.5GHz)	Agilent Technologies Inc	N9010A	SEM004-09	2018/4/13	2019/4/12
BiConiLog Antenna (26-3000MHz)	ETS-Lindgren	3142C	SEM003-01	2017/6/27	2020/6/26
Horn Antenna (0.8-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2018/4/13	2021/4/12
Pre-amplifier(0.1-1.3GHz)	HP	8447D	SEM005-02	2018/9/2	2019/9/2
Low Noise Amplifier(100MHz-18GHz)	Black Diamond Series	BDLNA-0118-352810	SEM005-05	2018/9/27	2019/9/27
Pre-amplifier(18-26GHz)	Rohde & Schwarz	CH14-H052	SEM005-17	2018/4/2	2019/4/1
Band filter	N/A	N/A	SEM023-01	N/A	N/A

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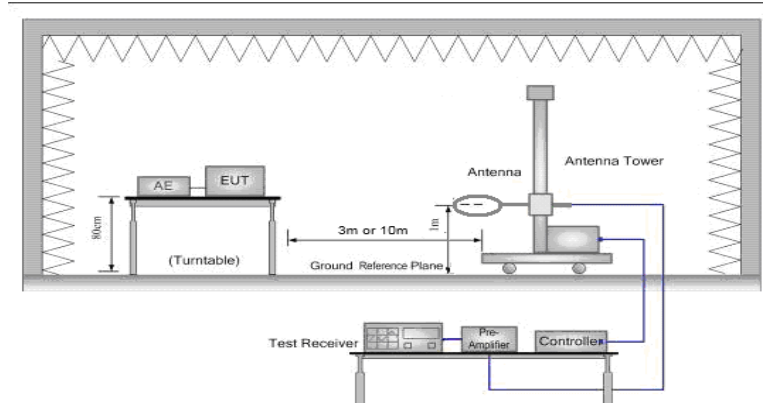
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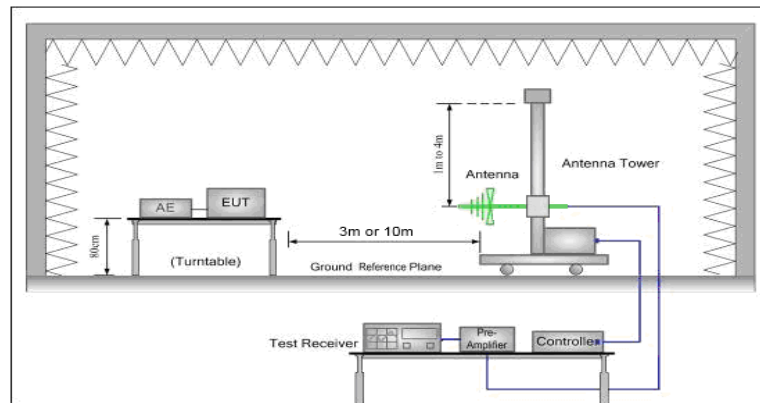
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10.3 Test SET-UP

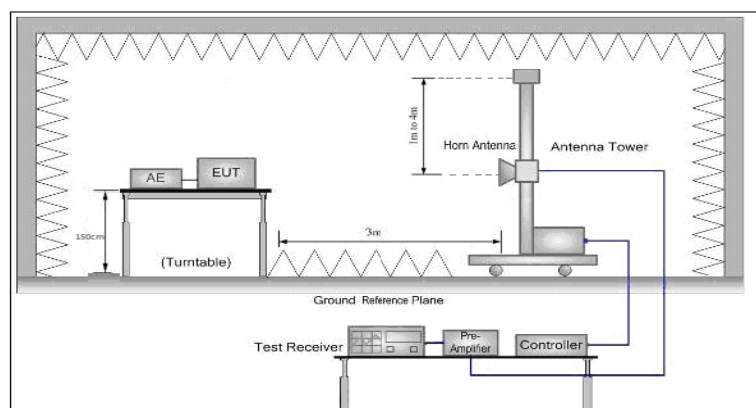
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



(B) Radiated Emission Test Set-Up, Frequency form 30MHz to 1000MHz



(C) Radiated Emission Test Set-UP Frequency Over 1 GHz



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10.4 Measurement Procedure

1. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
2. The EUT was placed on a turn table with 0.8m for frequency < 1GHz and 1.5m for frequency > 1GHz above ground plan.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
5. Set the spectrum analyzer as RBW=120 kHz and VBW=300 kHz for Peak Detector (PK) and Quasi-peak (QP) at frequency below 1 GHz.
6. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Peak Detector at frequency above 1 GHz.
7. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Detector at frequency above 1 GHz.
8. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “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.” is still within the 3dB illumination BW of the measurement antenna.
9. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
10. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
11. Repeat above procedures until all default test channel measured were complete.

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10.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

10.6 Test Results of Radiated Spurious Emissions form 9 kHz to 30 MHz

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

10.7 Measurement Result:

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

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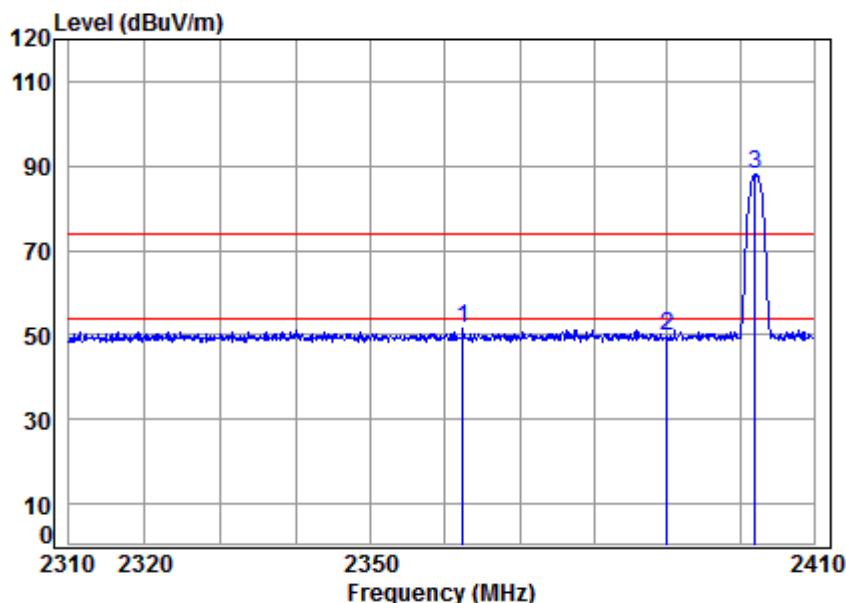
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10.7.1 Radiated Band Edge Measurement Result

10.7.1.1 Worst Case Mode(GFSK) Lowest Channel_ Peak_ Vertical



Site : chamber
Condition: 3m VERTICAL
Job No : 90027
Mode : 2402 Band edge
Note : BLE

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2362.372	5.44	28.47	41.86	59.33	51.38	74.00	-22.62	peak
2	2390.000	5.47	28.52	41.87	57.66	49.78	74.00	-24.22	peak
3 *	2402.000	5.49	28.54	41.88	95.92	88.07	74.00	14.07	peak

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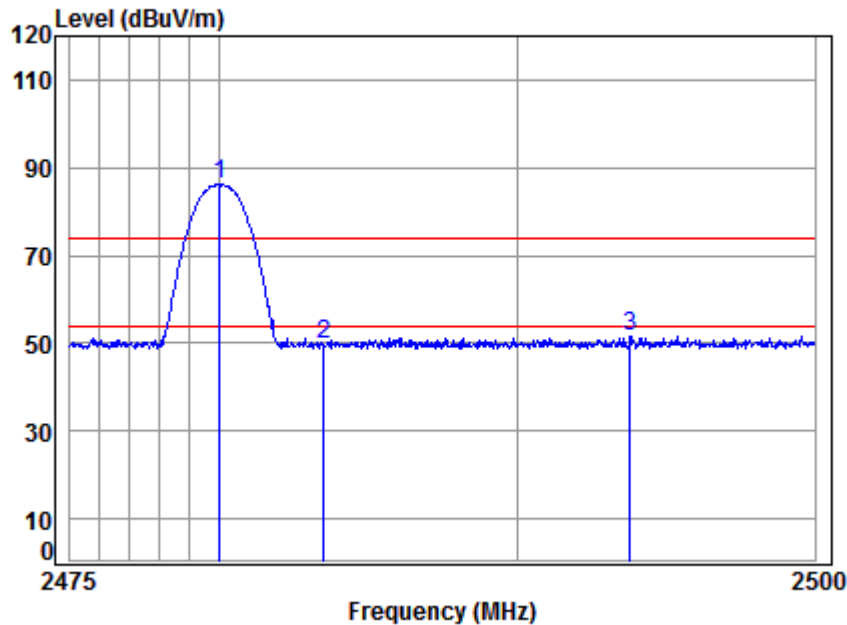
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10.7.1.2 Worst Case Mode(GFSK) Highest Channel_ Peak_ Vertical



Site : chamber
 Condition: 3m VERTICAL
 Job No : 90027
 Mode : 2480 Band edge
 Note : BLE

	Cable	Ant	Preamp	Read		Limit	Over	
Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1 * 2480.000	5.59	28.67	41.91	93.95	86.30	74.00	12.30	peak
2 2483.500	5.60	28.67	41.91	57.51	49.87	74.00	-24.13	peak
3 2493.777	5.61	28.69	41.91	59.37	51.76	74.00	-22.24	peak

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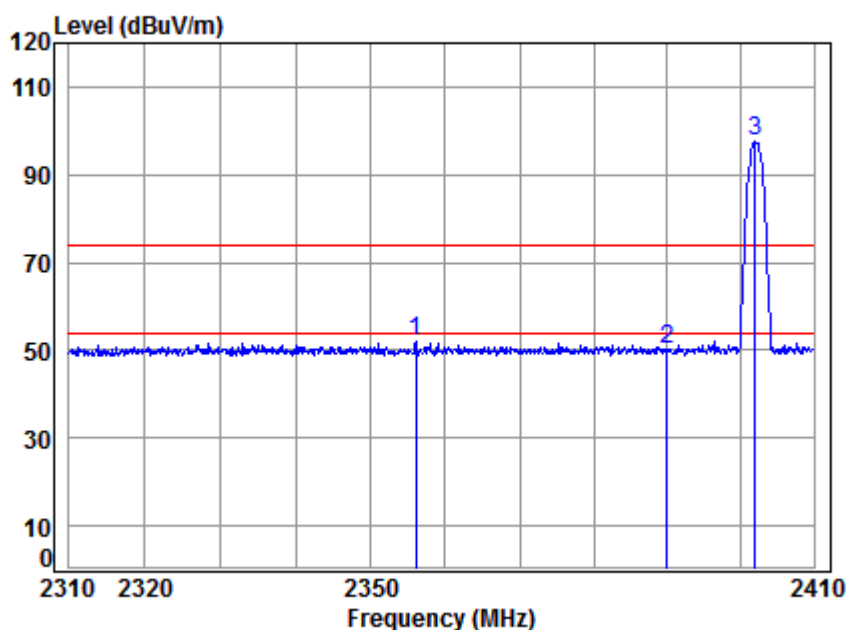
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10.7.1.3 Worst Case Mode(GFSK) Lowest Channel_ Peak_ Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No : 90027
Mode : 2402 Band edge
Note : BLE

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2356.073	5.43	28.46	41.86	59.88	51.91	74.00	-22.09	peak
2	2390.000	5.47	28.52	41.87	58.13	50.25	74.00	-23.75	peak
3 *	2402.000	5.49	28.54	41.88	105.31	97.46	74.00	23.46	peak

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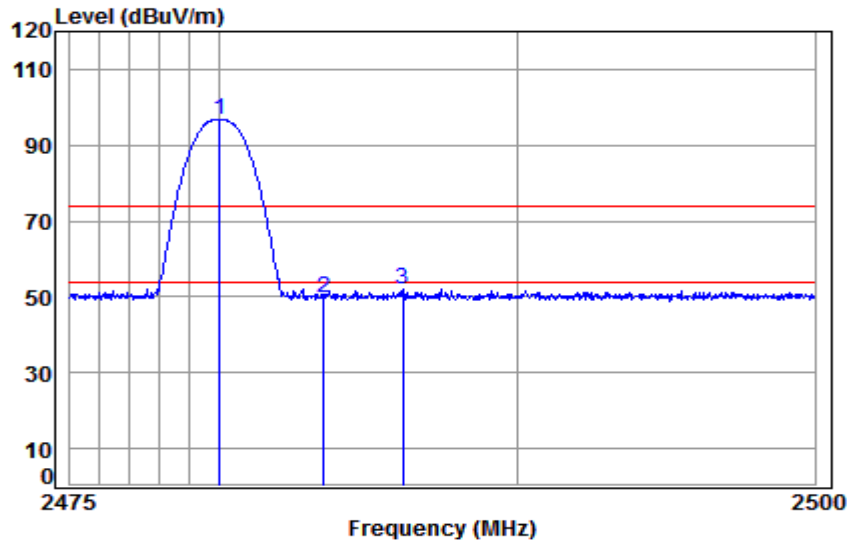
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10.7.1.4 Worst Case Mode(GFSK) Highest Channel_ Peak_ Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No : 90027
Mode : 2480 Band edge
Note : BLE

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1 *	2480.000	5.59	28.67	41.91	104.58	96.93	74.00	22.93	peak
2	2483.500	5.60	28.67	41.91	57.37	49.73	74.00	-24.27	peak
3	2486.144	5.60	28.68	41.91	59.82	52.19	74.00	-21.81	peak

Remark:

The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

All Modes have been tested, but only the worst case data displayed in this report.

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10.7.2 Radiated Emission below 1GHz

The test was performed at a 10m test site. According to below formulate and the test data at 10m test distance,

$$L_3 / L_{10} = D_{10} / D_3$$

Remark:

L₃: Level @ 3m distance. Unit: uV/m;

L₁₀: Level @ 10m distance. Unit: uV/m;

D₃: 3m distance. Unit: m

D₁₀: 10m distance. Unit: m

The level at 3m test distance is below:

Frequency (MHz)	Level @ 10m (dBuV/m)	Level @ 10m (uV/m)	Level @ 3m (uV/m)	Level @ 3m (dBuV/m)	Limit @ 3m (dBuV/m)	Over Limit (dB)	Ant. Polarization
47.49	14.70	5.43	18.11	25.16	40.00	-14.84	V
72.08	14.24	5.15	17.17	24.70	40.00	-15.30	V
166.07	14.65	5.40	18.00	25.11	43.50	-18.39	V
314.38	16.30	6.53	21.77	26.76	46.00	-19.24	V
499.42	19.33	9.26	30.86	29.79	46.00	-16.21	V
768.75	24.92	17.62	58.73	35.38	46.00	-10.62	V
40.70	15.57	6.00	20.02	26.03	40.00	-13.97	H
154.82	17.22	7.26	24.20	27.68	40.00	-12.32	H
257.42	15.64	6.05	20.18	26.10	43.50	-17.40	H
413.27	19.39	9.32	31.07	29.85	46.00	-16.15	H
654.23	25.15	18.09	60.31	35.61	46.00	-10.39	H
929.01	29.67	30.44	101.48	40.13	46.00	-5.87	H

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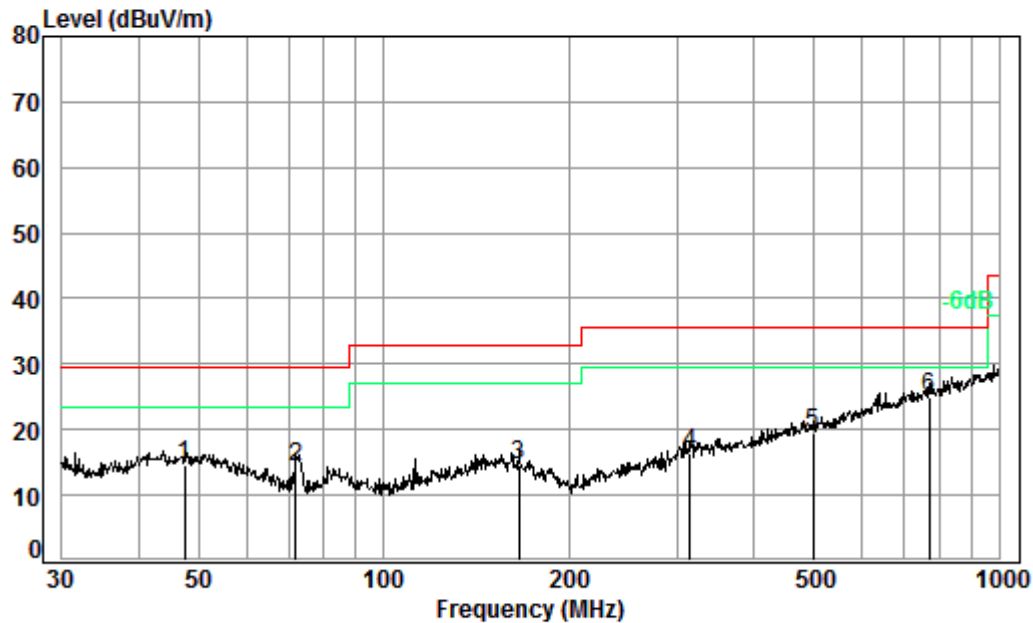
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10.7.2.1 Charge + Transmitting, Vertical



Condition: 10m VERTICAL

Job No. : 90027

Test Mode: c

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	47.49	6.89	12.84	32.45	27.42	14.70	29.50	-14.80
2	72.08	6.95	9.73	32.46	30.02	14.24	29.50	-15.26
3	166.07	7.50	12.79	32.42	26.78	14.65	33.00	-18.35
4	314.38	8.06	13.08	32.36	27.52	16.30	35.60	-19.30
5	499.42	8.60	16.78	32.35	26.30	19.33	35.60	-16.27
6 pp	768.75	9.23	20.99	32.20	26.90	24.92	35.60	-10.68

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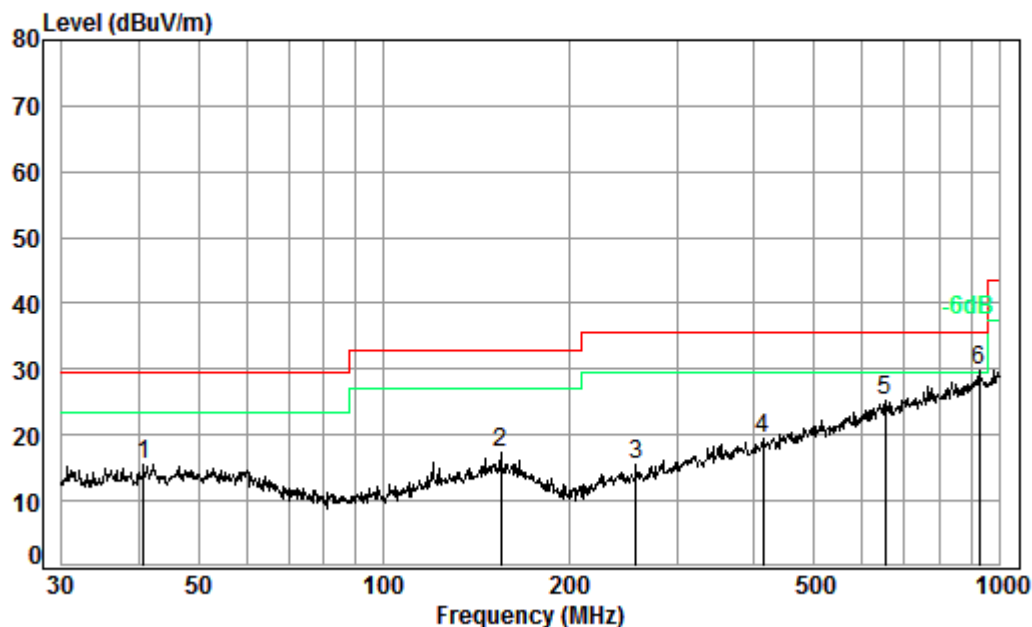
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10.7.2.2 Charge + Transmitting, Horizontal



Condition: 10m HORIZONTAL

Job No. : 90027

Test Mode: c

	Freq	Cable Loss	Ant Factor	Preamplifier Factor	Read Level	Level	Limit Line	Over Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	40.70	6.83	13.26	32.46	27.94	15.57	29.50	-13.93
2	154.82	7.46	13.40	32.43	28.79	17.22	33.00	-15.78
3	257.42	7.86	11.42	32.38	28.74	15.64	35.60	-19.96
4	413.27	8.35	15.23	32.34	28.15	19.39	35.60	-16.21
5	654.23	8.99	19.59	32.34	28.91	25.15	35.60	-10.45
6 pp	929.01	9.52	22.59	31.34	28.90	29.67	35.60	-5.93

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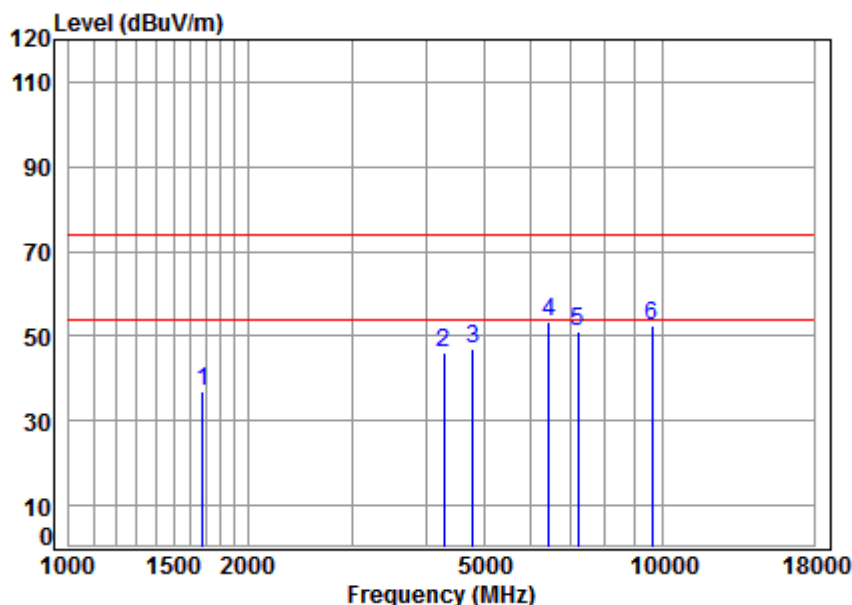
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10.7.3 Transmitter Emission above 1GHz

10.7.3.1 GFSK _Lowest Channel_ Peak_ Vertical



Site : chamber
 Condition: 3m VERTICAL
 Job No : 90027
 Mode : 2402 TX RSE
 Note : BLE

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1682.477	5.25	26.60	41.52	46.68	37.01	74.00	-36.99	peak
2	4279.589	7.31	33.22	42.38	48.09	46.24	74.00	-27.76	peak
3	4804.000	7.89	33.97	42.47	47.66	47.05	74.00	-26.95	peak
4	6432.732	11.41	35.54	41.27	47.86	53.54	74.00	-20.46	peak
5	7206.000	10.08	36.07	40.71	45.88	51.32	74.00	-22.68	peak
6	9608.000	10.75	37.67	37.74	41.77	52.45	74.00	-21.55	peak

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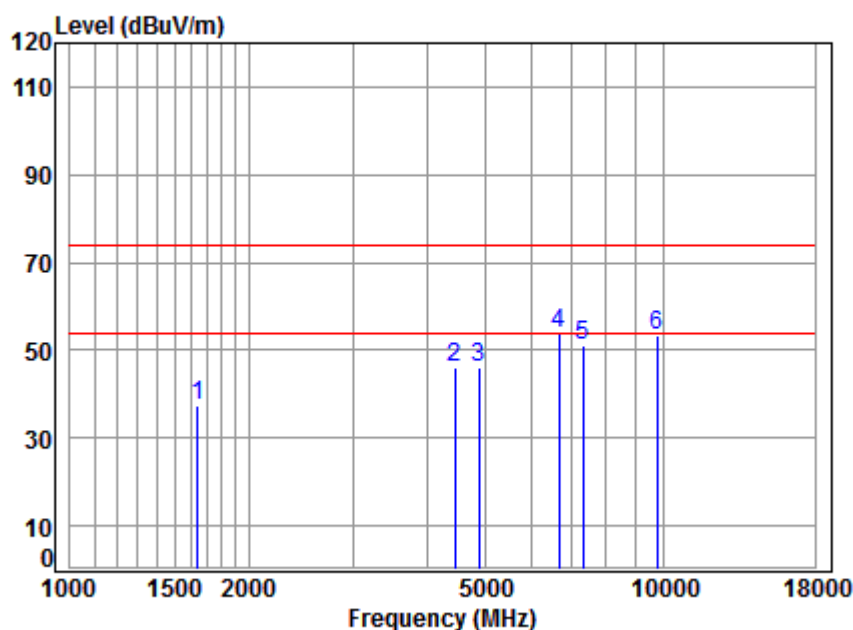
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10.7.3.2 GFSK _Middle Channel_ Peak_ Vertical



Site : chamber
 Condition: 3m VERTICAL
 Job No : 90027
 Mode : 2440 TX RSE
 Note : BLE

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1639.274	5.30	26.42	41.49	47.00	37.23	74.00	-36.77	peak
2	4456.315	7.51	33.53	42.41	47.60	46.23	74.00	-27.77	peak
3	4880.000	7.97	34.06	42.48	46.39	45.94	74.00	-28.06	peak
4	6679.040	11.02	35.71	41.08	48.12	53.77	74.00	-20.23	peak
5	7320.000	10.05	36.16	40.63	45.50	51.08	74.00	-22.92	peak
6	9760.000	10.82	37.76	37.53	42.22	53.27	74.00	-20.73	peak

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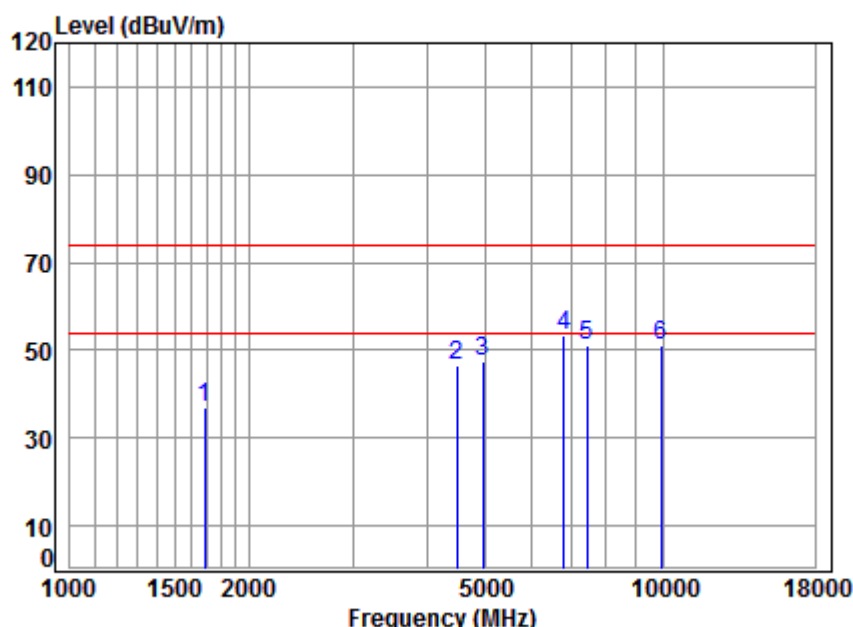
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10.7.3.3 GFSK _High Channel_ Peak_ Vertical



Site : chamber
Condition: 3m VERTICAL
Job No : 90027
Mode : 2480 TX RSE
Note : BLE

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1687.347	5.24	26.62	41.52	46.56	36.90	74.00	-37.10	peak
2	4495.125	7.55	33.59	42.42	47.92	46.64	74.00	-27.36	peak
3	4960.000	8.05	34.15	42.49	47.65	47.36	74.00	-26.64	peak
4	6795.879	10.69	35.78	41.00	47.96	53.43	74.00	-20.57	peak
5	7440.000	10.02	36.25	40.56	45.41	51.12	74.00	-22.88	peak
6	9920.000	10.90	37.85	37.31	39.56	51.00	74.00	-23.00	peak

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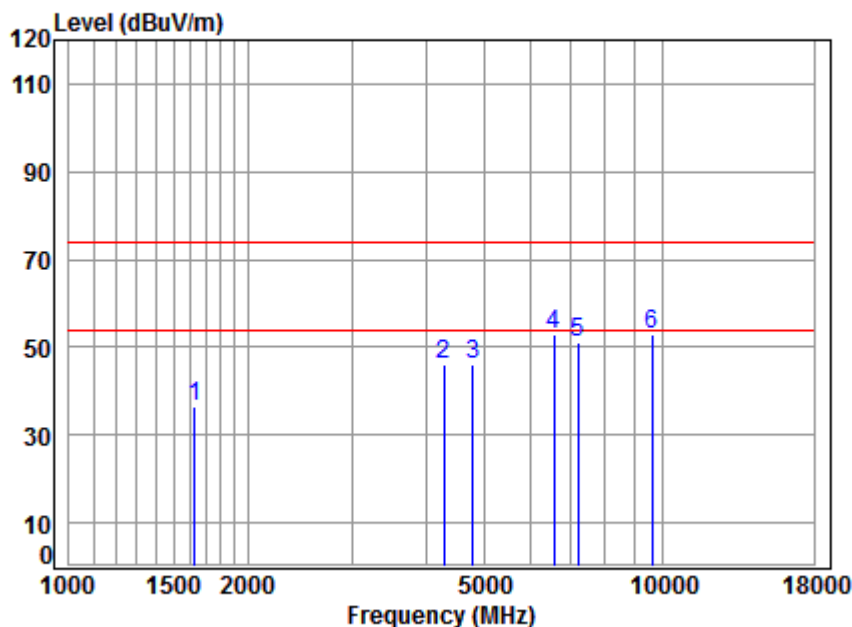
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10.7.3.4 GFSK _Lowest Channel_ Peak_ Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No : 90027
Mode : 2402 TX RSE
Note : BLE

	Freq	Cable Loss	Ant Factor	Preamplifier Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1629.825	5.31	26.38	41.49	46.48	36.68	74.00	-37.32	peak
2	4279.589	7.31	33.22	42.38	48.12	46.27	74.00	-27.73	peak
3	4804.000	7.89	33.97	42.47	46.69	46.08	74.00	-27.92	peak
4	6564.209	11.35	35.64	41.17	47.06	52.88	74.00	-21.12	peak
5	7206.000	10.08	36.07	40.71	45.48	50.92	74.00	-23.08	peak
6	9608.000	10.75	37.67	37.74	42.11	52.79	74.00	-21.21	peak

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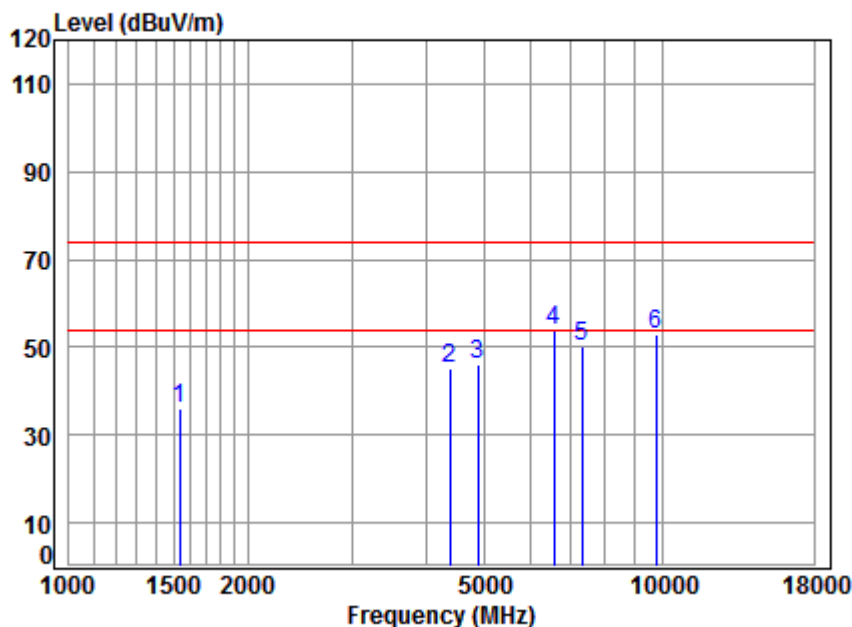
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10.7.3.5 GFSK _Middle Channel_ Peak_ Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No : 90027
Mode : 2440 TX RSE
Note : BLE

	Freq	Cable Loss	Ant Factor	Preamplifier Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1533.841	5.44	25.96	41.43	46.25	36.22	74.00	-37.78	peak
2	4379.699	7.43	33.39	42.40	46.92	45.34	74.00	-28.66	peak
3	4880.000	7.97	34.06	42.48	46.63	46.18	74.00	-27.82	peak
4	6564.209	11.35	35.64	41.17	48.17	53.99	74.00	-20.01	peak
5	7320.000	10.05	36.16	40.63	44.77	50.35	74.00	-23.65	peak
6	9760.000	10.82	37.76	37.53	41.95	53.00	74.00	-21.00	peak

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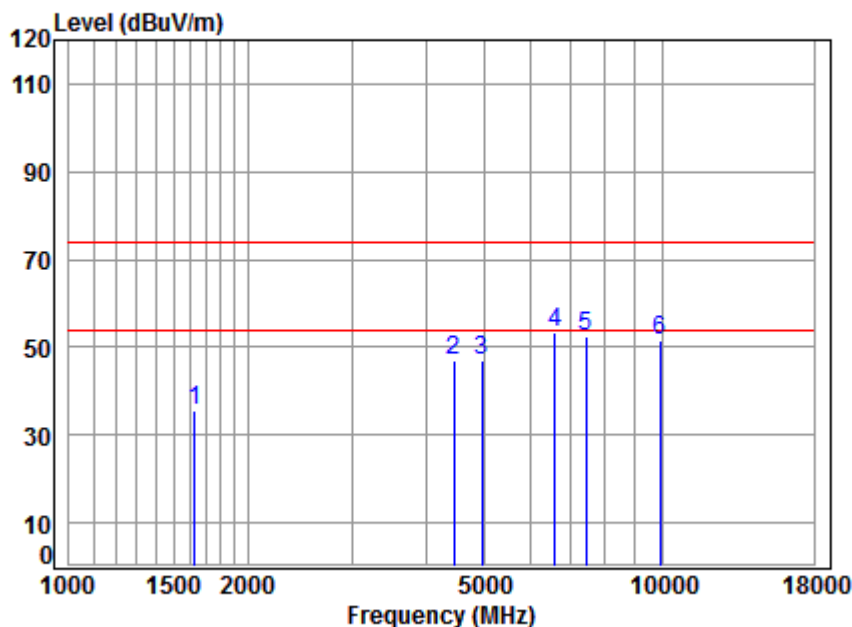
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10.7.3.6 GFSK _High Channel_ Peak_ Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No : 90027
Mode : 2480 TX RSE
Note : BLE

	Freq	Cable Loss	Ant Factor	Preamplifier Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1629.825	5.31	26.38	41.49	45.55	35.75	74.00	-38.25	peak
2	4456.315	7.51	33.53	42.41	48.25	46.88	74.00	-27.12	peak
3	4960.000	8.05	34.15	42.49	47.41	47.12	74.00	-26.88	peak
4	6602.265	11.24	35.66	41.14	47.65	53.41	74.00	-20.59	peak
5	7440.000	10.02	36.25	40.56	46.79	52.50	74.00	-21.50	peak
6	9920.000	10.90	37.85	37.31	39.95	51.39	74.00	-22.61	peak

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Remark:

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

- 2) Scan from 9kHz to 25GHz, the disturbance between 9KHz to 30MHz was very low, and the above harmonics were the highest point could be found when testing, The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.
- 3) As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.
- 4) All Modes have been tested, but only the worst case data displayed in this report.

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11 PEAK POWER SPECTRAL DENSITY

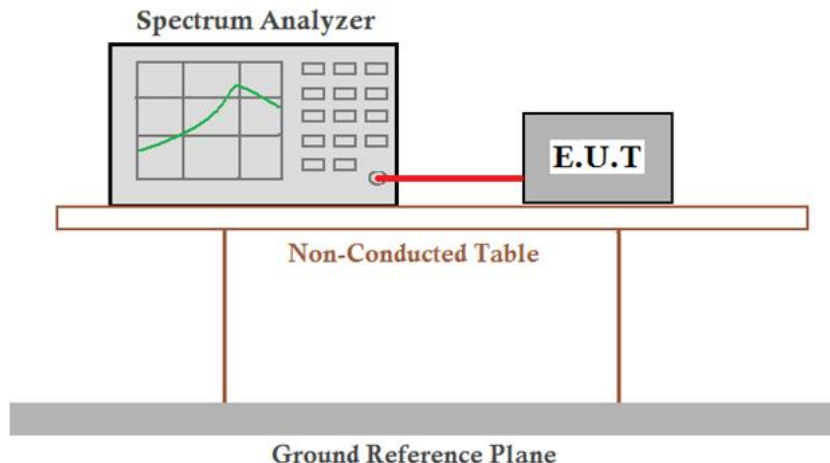
11.1 Standard Applicable:

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

11.2 Measurement Equipment Used:

Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy-mm-dd)	Cal.Duedate (yyyy-mm-dd)
DC Power Supply	Agilent Technologies Inc.	66311B	W009-09	2018/9/15	2019/9/15
Signal Analyzer	Rohde & Schwarz	FSV	W025-05	2018/3/13	2019/3/12
Coaxial Cable	SGS	N/A	SEM031-01	2018/7/13	2019/7/12
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2018/9/2	2019/9/2
Temperature Chamber	GIANT FORCE	ICT-150-40-CP-AP	W027-03	2018/11/27	2019/11/27
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2018/9/2	2019/9/2

11.3 Test Set-up:



11.4 Measurement Procedure:

1. Set analyzer center frequency to DTS channel center frequency.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW = 3 kHz. & the VBW = 10 kHz

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5. For defining Restricted Band Edge Limit:

Set the RBW = 100kHz & VBW = 300 kHz.

6. Detector = peak.

7. Sweep time = auto couple.

8. Trace mode = max hold.

9. Allow trace to fully stabilize.

10. Use the peak marker function to determine the maximum amplitude level.

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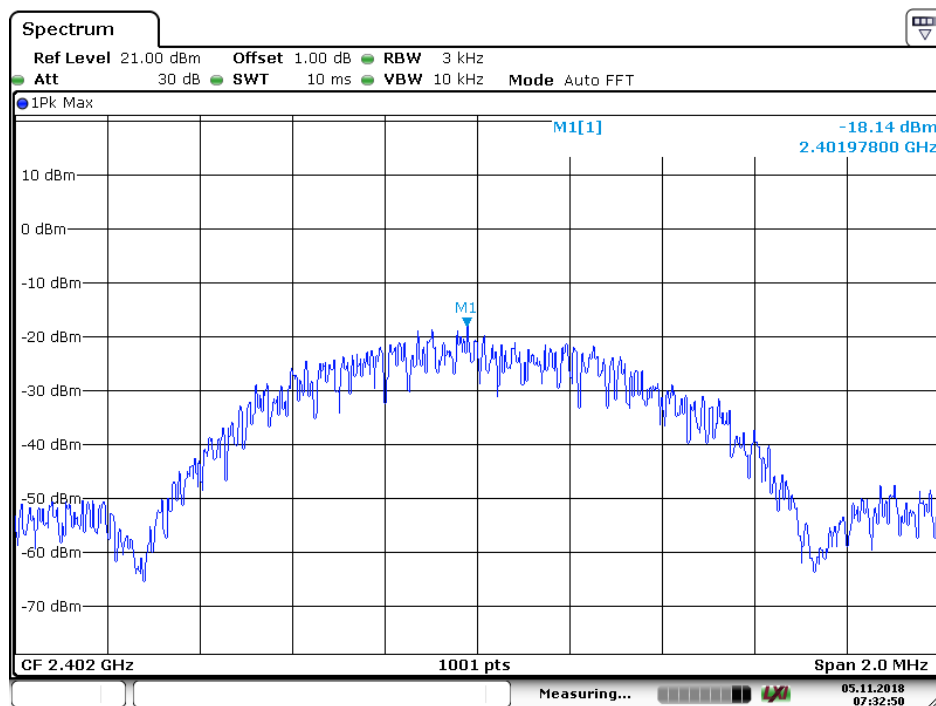
11.5 Measurement Result:

Mode	Test Channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
GFSK 1M	Lowest	-18.14	≤8.00	Pass
	Middle	-17.25	≤8.00	Pass
	Highest	-18.29	≤8.00	Pass

Mode	Test Channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
GFSK 2M	Lowest	-20.32	≤8.00	Pass
	Middle	-19.44	≤8.00	Pass
	Highest	-20.48	≤8.00	Pass

11.5.1 BLE mode

11.5.1.1 Power Spectral Density Test Plot 1M Mode CH-Low



Date: 5 NOV. 2018 07:32:50

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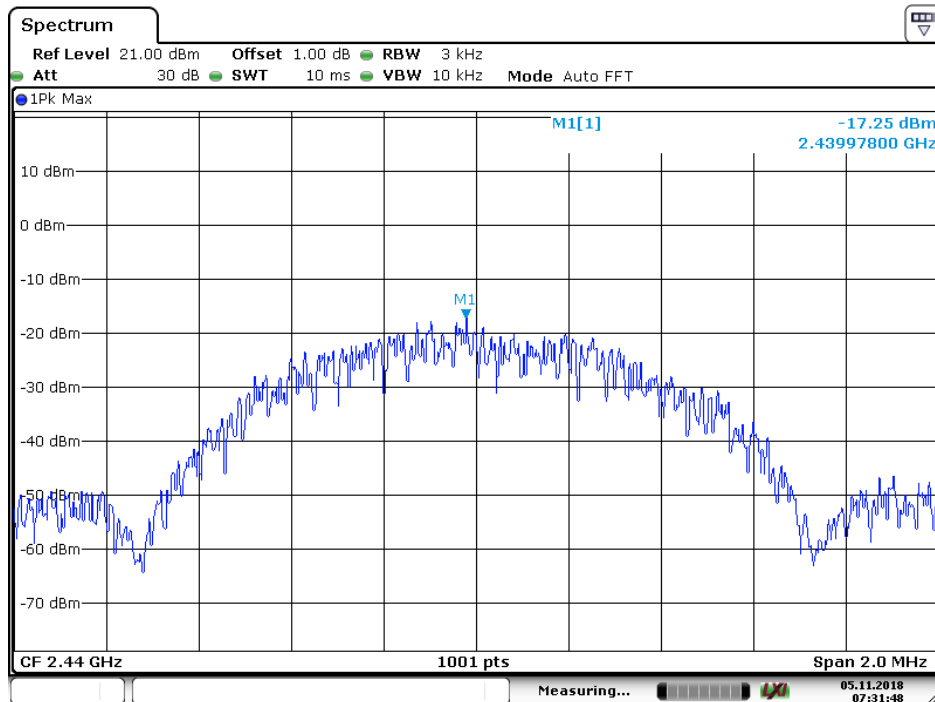
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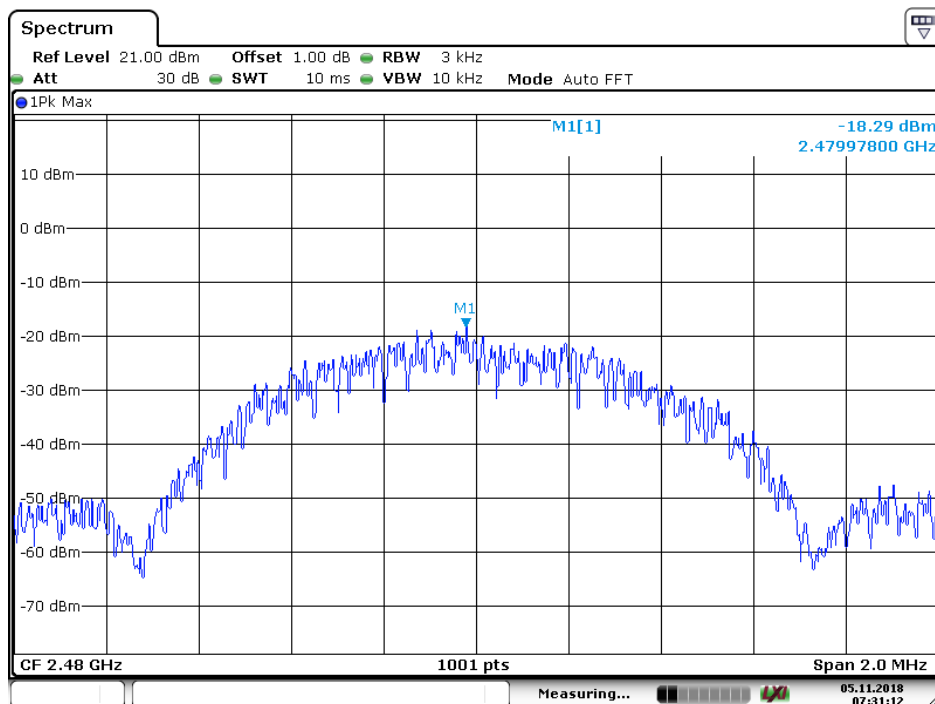
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11.5.1.2 Power Spectral Density Test Plot 1M Mode CH-Mid



Date: 5 NOV. 2018 07:31:48

11.5.1.3 Power Spectral Density Test Plot 1M Mode CH-High



Date: 5 NOV. 2018 07:31:12

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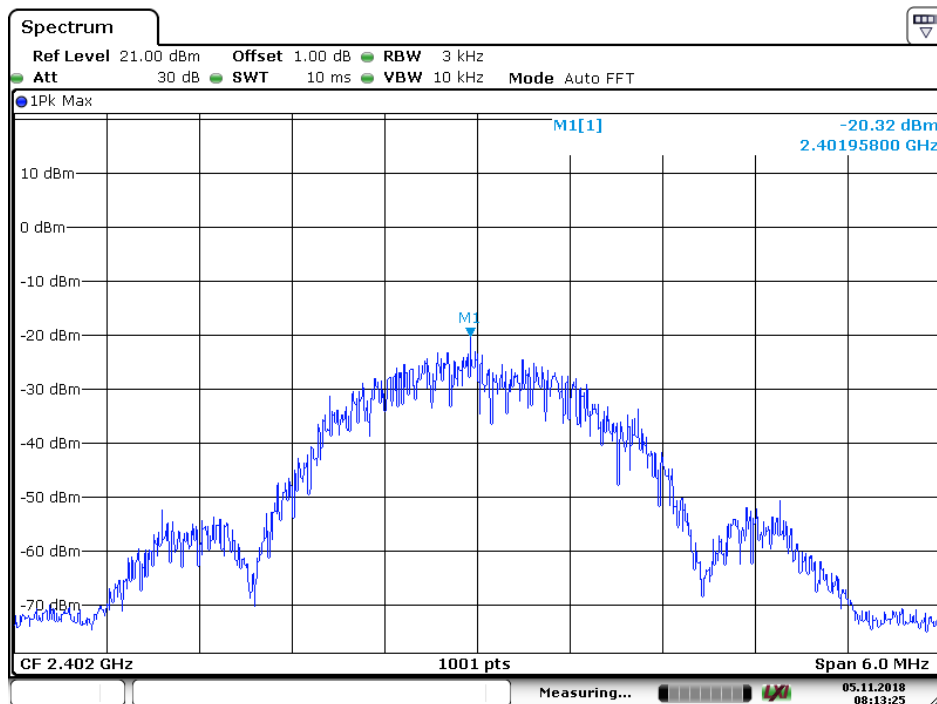
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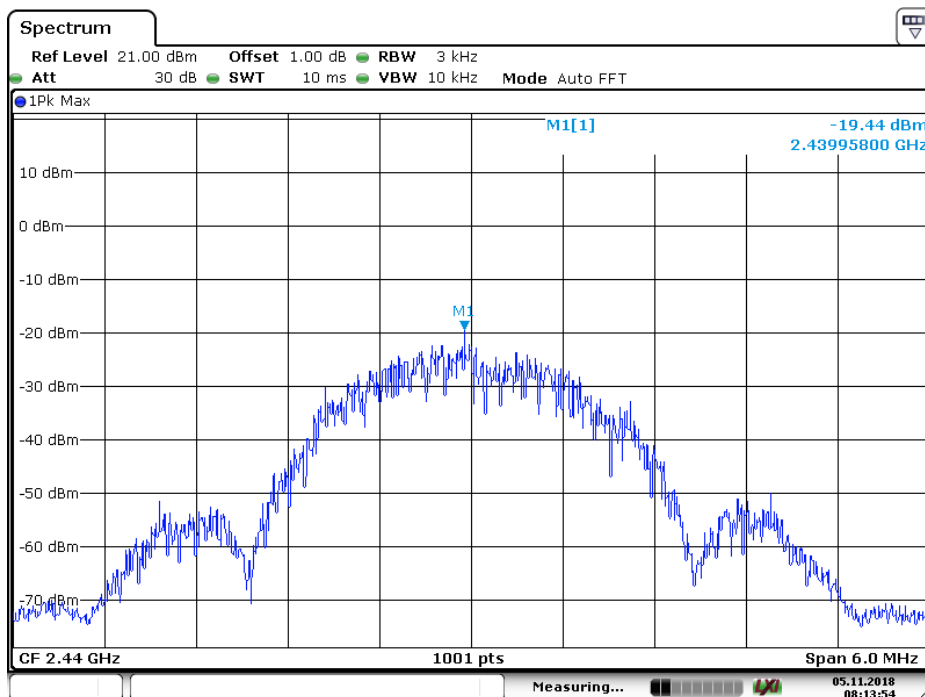
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11.5.1.4 Power Spectral Density Test Plot 2M Mode CH-Low



Date: 5 NOV 2018 08:13:26

11.5.1.5 Power Spectral Density Test Plot 2M Mode CH-Mid



Date: 5 NOV 2018 08:13:54

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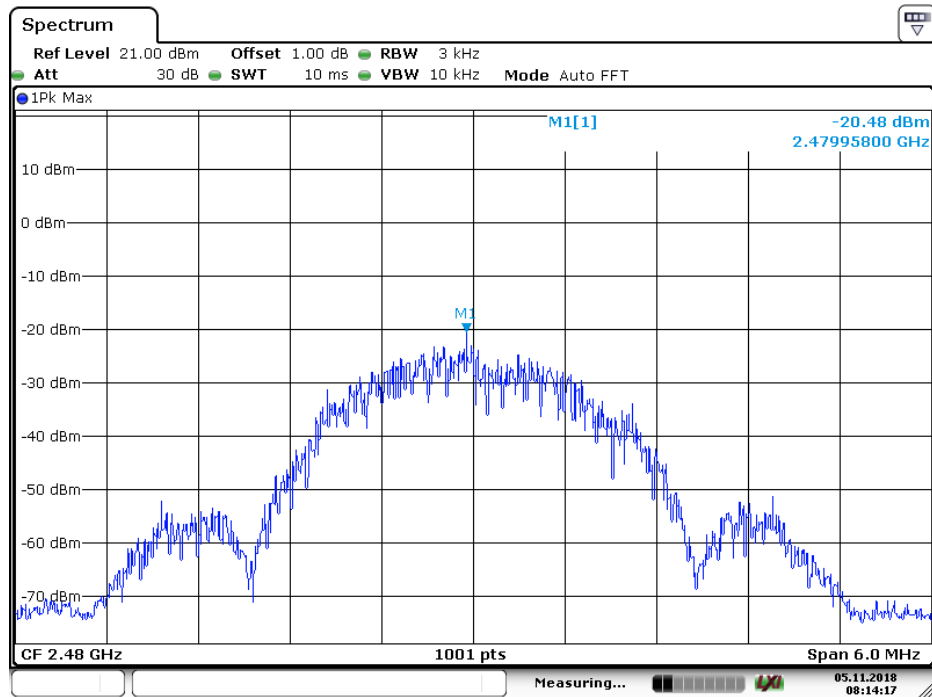
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11.5.1.6 Power Spectral Density Test Plot 2M Mode CH-High



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12 ANTENNA REQUIREMENT

12.1 Standard Applicable:

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

If the transmitting antenna is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi.

In case of point-to-point operation, the power shall be reduced by the one dB for every 3 dB that the directional gain of antenna exceeds 6dBi.

12.2 Antenna Connected Construction:

The antenna is designed as permanently attached and no consideration of replacement. Please see EUT photo for details.

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13 PHOTOGRAPHS - EUT TEST SETUP DETAILS

Refer to Appendix A - Photographs of EUT Test Setup Details for ZR/2018/A0011.

~ End of Report ~

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