RADIO TEST REPORT

47 CFR FCC PART 15.247
RSS-GEN ISSUE 4
RSS-247 ISSUE 1

Report Number:	CFR-CWD7550-10202016
Test Dates:	8/30, 8/31, 9/1, 9/6, 9/7, 9/8, 9/9, 9/12/2016

EWO:	**2233**

Model:	**CWD7550**

FCC ID:	EROCWD7550
IC:	5683C- CWD7550

FRN:	0005022819
ADDRESS:	15 Volvo Dr, Rockleigh, NJ 07647

Report Date:

Test Result:	Pass

Prepared by: Hirayr M. Kudyan Date: 10/20/2016

Hirayr M. Kudyan, PhD, PE, NCE
Senior Compliance Engineer

Reviewed by: Date: 11/7/2016

Gary Freed
Global Compliance Manager

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Revision History

Revision	Description	Date
00	Initial release	10/20/2016
01	Test dates added (highlighted in magenta)	11/04/2016

1. Reference Standards

Measurements were performed according to the following procedures and standards:

1) ANSI C63.4: 2014
2) FCC Publication, "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating under §15.247", June 5, 2014
3) Industry Canada RSS-Gen Issue 4
4) Industry Canada RSS-247 Issue 1
5) Industry Canada ICES-003 Issue 5
6) ANSI C63.10: 2013

All measurements were performed in a 3-meter semi-anechoic chamber and the control room.

1.1 Test Facility

The 3-meter semi-anechoic chamber used to collect conducted and radiated emission data is located at 22 Link Drive, Rockleigh, New Jersey. This test facility has been placed on file with the FCC, Registration Number: 412871, and Industry Canada, Site Number: 5683C-1.

2. System Test Configuration

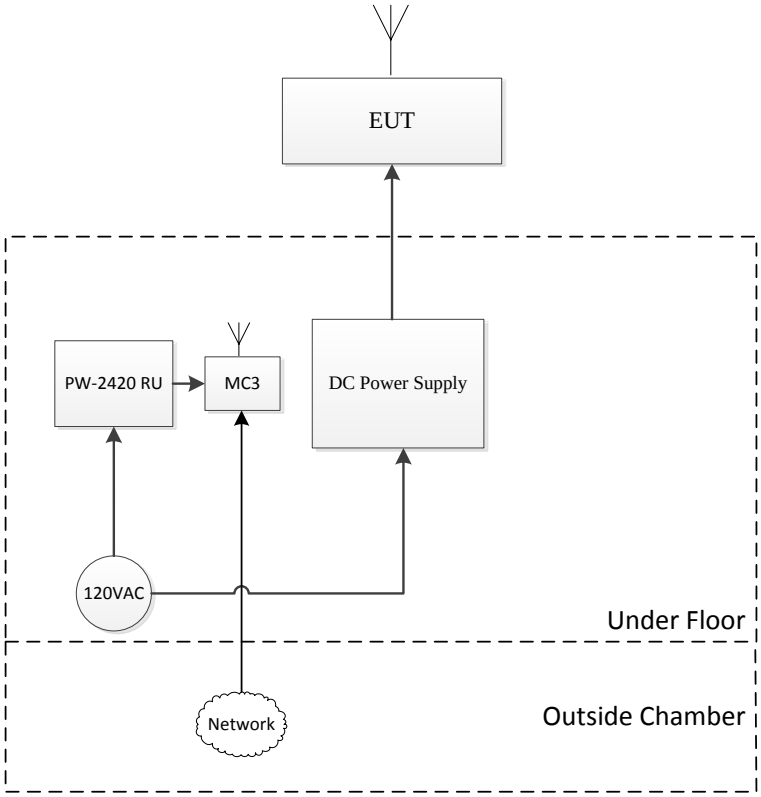
2.1 Product Description

The equipment under test (EUT) is a Zigbee radio module, manufactured by Crestron Electronics, Inc.

Model Number: CWD7550

2.2 Block Diagram

Test Setup Block Diagram



Note:
PC/laptop used for sending commands to the MC3 via its LAN or USB ports not shown in diagram.

2.3 EUT Setup Justification

The setup was configured for testing in a representative user configuration with nominal interface data activity to imitate EUT functions. For Radiated and Conducted radio emissions testing, "*rftelec*" command was used to control carrier modulation, frequency, duration and RF power level. For radio Duty-Cycle measurements the "*testpacket*" command was used to have the EUT broadcast test packets as a "client" node.

2.4 EUT Exercise Software and Mode(s) of Operation

For radio Conducted and Radiated tests, the EUTs were configured to transmit continuously, with pseudorandom carrier modulation, mostly over the following channels:

Channel 11 (2405 MHz)
Channel 18 (2440 MHz)
Channel 24 (2470 MHz)
Channel 25 (2475 MHz)
Channel 26 (2480 MHz)

During radio Conducted tests, the MC3 controller (hence EUT remotely) was controlled via the MC3 USB port. For radio Radiated and Duty-Cycle measurement tests, the MC3 was controlled via the MC3 LAN port.

A. **Step-by-step Operating Instruction and Test Setup Block Diagram (under normal operation for duty cycle measurement)**

Step-by-step Operating Instructions:

1. Plug PW-2420 RU into 120VAC supply and MC3
2. Attach 2x 18AWG twisted wires to EUT +5V and GND and DC Power Supply +5V and GND
3. Plug Ethernet cable into MC3
4. Press Acquire button on MC3 and red LED should light up
5. Press top button on EUT 4 times and on the fourth time hold it down until the top LED blinks once and then release (this can take up to 10 seconds)
6. Once the LED stops blinking press the Acquire button on the MC3 again and the red LED should turn off
7. For a one time setup connect to the MC3 with a PC and USB cable
8. Through Crestron Toolbox open a text console to the MC3 and get it's IP address using the IPCONFIG command
9. Also get the TSID of the EUT that was just acquired to the MC3 with Network Device Discovery
10. Disconnect USB cable from MC3
11. Through any other network connected device open up a console to the MC3 through Crestron Toolbox by using the MC3 IP address
12. Use the "TESTPACKET" command to setup the control system to have the EUT to send data at its maximum duty cycle.
    a. TESTPACKET [mode] [TSID|ALL] [num packets] [packet length][delay between packets]
       Mode – 0 client sends packets to gateway; 1 - gateway sends packets to client(s)
       TSID - device TSID <########>
       ALL – all devices
       Num packets – [0-65535]
       Packet length – [0 – 56]
       Delay between packets – [0 – 65535]
    b. Issue command "TESTPACKET 0 ######## 65535 56 0"

B. Step-by-step Operating Instruction and Test Setup Block Diagram (under test mode)

Step-by-step Operating Instructions:

1. Plug PW-2420 RU into 120VAC supply and MC3
2. Orient the EUT PCB perpendicular to the floor with the antenna at the top. This is the only intended orientation for this EUT.
3. Attach 2x 18AWG twisted wires to EUT +5V and GND and DC Power Supply +5V and GND
4. Plug Ethernet cable into MC3
5. Press Acquire button on MC3 and red LED should light up
6. Press top button on EUT 4 times and on the fourth time hold it down until the top LED blinks once and then release (this can take up to 10 seconds)
7. Once the LED stops blinking press the Acquire button on the MC3 again and the red LED should turn off
8. For a one time setup connect to the MC3 with a PC and USB cable
9. Through Crestron Toolbox open a text console to the MC3 and get it's IP address using the IPCONFIG command
10. Also get the RFID of the EUT that was just acquired to the MC3 with Network Device Discovery
11. Disconnect USB cable from MC3
12. Through any other network connected device open up a console to the MC3 through Crestron Toolbox by using the MC3 IP address
13. Use the "RFRCON X" command to open up a console to the EUT where X is the Cresnet ID of the EUT
14. Use the "RFTELEC" command to setup the control system to have the EUT to send data at its maximum duty cyle.
    a. TX PR data: RFTELEC 1 [ch] [pwr] [time]
       RX only: RFTELEC 2 [ch] [time]
       TX carrier: RFTELEC 4 [ch] [pwr] [time]
       TX sequence: RFTELEC 5 [ch] [pwr] [cnt] [seed]
       RX sequence: RFTELEC 6 [ch] [seed] [time]
    b. Example: Issue command "RFRCON X "RFTELEC 1 11 0 200"" to transmit pseudo random data on channel 11 at maximum power for 200 seconds.
    c. Example: Issue command "RFRCON X "RFTELEC 1 26 245 100"" to transmit pseudo random data on channel 11 at 17.95dBm for 100 seconds.

PA7550 Transmit Power Setup Table

EM358 Power set (dBm)	Power setting command decimal	2405 (MHz) output power (dBm)	2440 (MHz) output power (dBm)	2480 (MHz) output power (dBm)
-43	224	-40.965	-40.315	-40.117
-26	230	-2.173	-1.602	-1.477
-20	236	3.812	4.359	4.599
-17	239	7.312	7.887	8.145
-14	242	9.691	10.289	10.58
-12	244	11.630	12.277	12.622
-11	245	13.312	13.958	14.295
-9	247	14.783	15.483	15.757
-8	248	15.848	16.547	16.865
-7	249	16.982	17.519	17.772
-6	250	17.828	18.409	18.619
-5	251	18.65	19.13	19.17
-4	252	19.888	20.22	20.075
-3	253	20.74	20.91	20.66
-2	254	21.417	21.427	21.077

Power setup information

PA7550 Channel Setup Table

Channel (decimal)	Channel (hexadecimal)	Frequency (MHz)
11	**0B**	**2405**
12	0C	2410
13	0D	2415
14	0E	2420
15	0F	2425
16	10	2430
17	11	2435
18	**12**	**2440**
19	13	2445
20	14	2450
21	15	2455
22	16	2460
23	17	2465
24	18	2470
25	19	2475
26	**1A**	**2480**

2.5 Cables

Qty	Description	Length (m)	From - To	Shielded/ Unshielded
1	Ethernet Cable	4	MC3 – Network	Unshielded
1	2x 18AWG twisted wires	2	DC Power Supply – EUT	Unshielded
1	MXHQ87PA3000	0.3	EUT – Rohde & Schwartz Spectrum Analyzer	Shielded

2.6 Special Accessories

There are no special accessories for compliance of this EUT.

2.7 Support equipment

No	Description	Manufacturer	Model No	Serial No
1	Control System	Crestron	MC3	10689355
2	ITE Power Supply	Crestron	PW-2420 RU	ROHS340986148/11
3	DC Power Supply	BK Precision	1550DC	15501106

2.8 Equipment Modification

There were no modifications installed during compliance measurements.

2.9 Test Equipment

Equipment Type	Frequency Range	Make	Model No.	Serial No.	Cal. Done by	Cal. Date	Cal. Due Date
EMI Receiver	20Hz–40GHz	R&S	ESU40	100076	R & S	09/17/2015	09/17/2016
Bilog Antenna	30MHz–2GHz	Teseq	CBL 6112D	25231	Liberty Labs, Inc	09/08/2015	09/08/2016
Double Ridge Horn Antenna	1GHz–18GHz	ETS-Lindgren	3117	00047560	Liberty Labs, Inc	09/04/2015	09/04/2016
Preamplifier	1GHz–18GHz	R&S	TS-PR18	100044	Liberty Labs, Inc	09/08/2015	09/08/2016
ETS-Lindgren Standard Gain Rectangular Horn Antenna	18GHz–26.5GHz	ETS-Lindgren	3160-09	00078911	Liberty Labs, Inc	12/3/2010	09/08/2016
Preamplifier	18GHz–26.5GHz	R&S	TS-PR26	100030	Liberty Labs, Inc	09/08/2015	09/08/2016
LISN	150KHz-30MHz	R&S	ENV-216	101122	Liberty Labs, Inc.	09/08/2015	09/08/2016

All instruments are calibrated in accordance with the manufacturer's recommendations.
All antennas are calibrated per ANSI C63.5.
All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration system.

Antenna Model number 3117 Serial Number 00047560 and model number 3160-09 serial number 00078911 were sent out to the calibration laboratory for calibration and found to be in tolerance during their biannual calibration in October of 2016 New calibration due dates are 10/13/2018 and 10/11/2018 respectively.

3. Test Results

3.1 Compliance Statement

Rule Section		Description	Date of Test (mm/dd/yy)	Test Engineer	Results
FCC	IC				
§15.203	§8.3 of RSS-Gen	Antenna Requirement	-	-	Complies
§15.247(a)(2)	§5.2(1) of RSS-247	6 dB Bandwidth, 500 kHz	8/30/2016	Hirayr M. Kudyan	Complies
N/A	§6.6 of RSS-Gen	99% Occupied Bandwidth	8/30/2016	Hirayr M. Kudyan	(for reporting purpose)
§15.247(b)(3)	§5.4(4) of RSS-247	Power Output, conducted, 1 Watt (30dBm)	8/31/2016, 9/9/2016	Hirayr M. Kudyan	Complies
§15.247(d)	§A5.5 of RSS- 247	Band Edge	8/31/2016	Hirayr M. Kudyan	Complies
§15.247(d)	§5.5 of RSS-247	Conducted Spurious Emissions, -20 dBc	8/31/2016	Hirayr M. Kudyan	Complies
§15.247(e)	§5.2(2) of RSS-247	Power Spectral Density (PSD), 8 dBm in any 3 kHz band.	8/31/2016	Hirayr M. Kudyan	Complies
§15.205, §15.209, §15.247(d)	§5.5 of RSS-247; §8.9 of RSS-Gen	Radiated Spurious Emissions	8/31, 9/1, 9/6, 9/7, 9/8, 9/9, 9/12/2016	Hirayr M. Kudyan	Complies*
§15.207	§8.8 of RSS-Gen	Transmitter AC Power Line Conducted Emissions	8/31/2016	Hirayr M. Kudyan	Complies

*See limitations on Channel 26 power level settings to meet Upper Band Edge criteria under Radiated Spurious Emissions.

Note:
The channels selected for test were 11, 18, 24, 25 and 26.

3.2 Antenna Requirements

The product uses an Antenova Mica (A5645) SMD antenna chip mounted on the EUT PCB (see photo below):

The antenna chip cannot be replaced externally and is compliant with FCC §15.203, §15.204(b), and §15.204(c).

The maximum gain of the antenna is 1.9dBi.

The relevant parts of antenna document are exhibited below for more details:

4 Model name

30 30 A5645 - 01

- A5645 - 01 — Drawing No.
- 30 — Technology -PCB
- 30 — Antenna Family -SMD

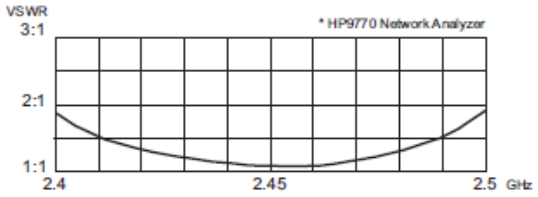
5 General data

Product Name	Mica 2.4 GHz
Article No.	3030A5645-01
Frequency	2.4-2.5 GHz
Polarization	Linear
Operating temperature	-40 to + 85 degC
Impedance	50 Ohm
Weight	0.4 gram
Antenna type	SMD

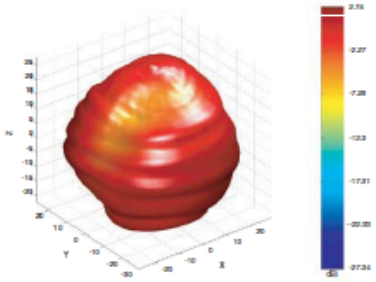
6 Electrical characteristics

	Characteristics			Conditions*
	Min	Typ	Max	
Peak Gain	0.8 dBi	1.2 dBi	1.9 dBi	Frequency 2.4-2.5 GHz, Measured in 3D chamber (near field)
Efficiency	70%	75%	79%	
VSWR	1.0:1	1.5:1	1.9:1	Frequency 2.4-2.5 GHz, Measured in Network Analyzer
*Note all data provided in this table are based on the gigaNOVA™ reference board				

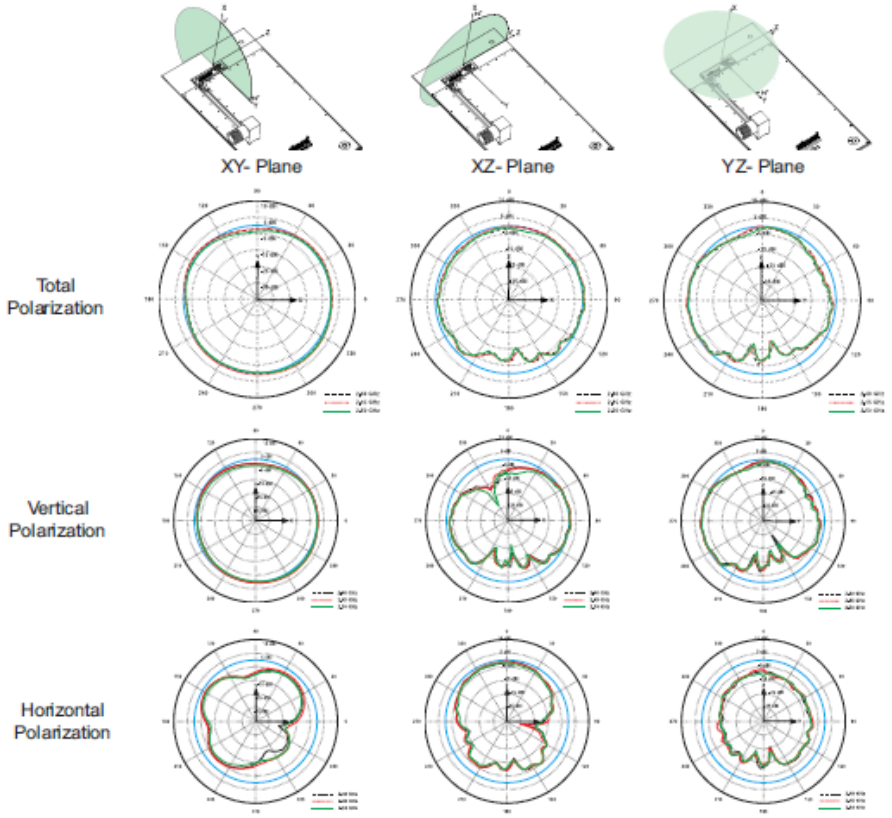
7 Electrical performance



7-2 3D-Radiation



7-3 Radiation patterns



3.3 6 dB bandwidth

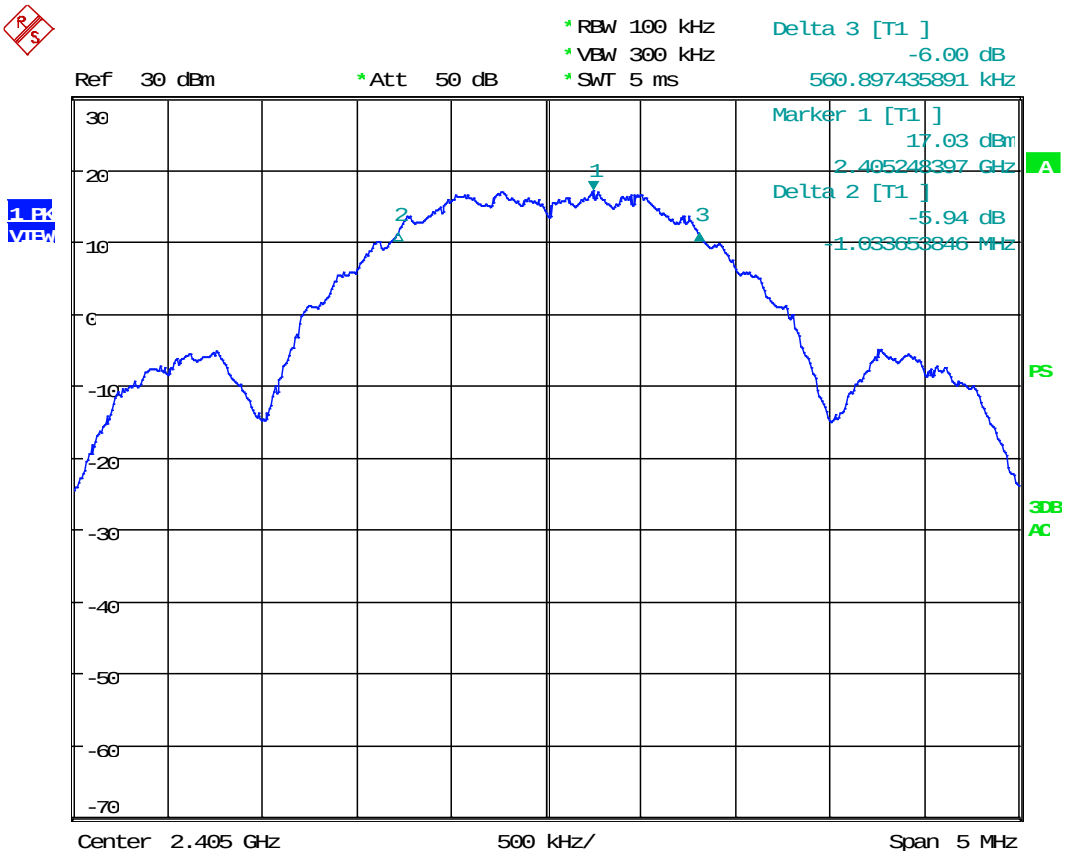
Criterion: The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Procedure: Per 558074 D01 DTS Meas Guidance v03r02 § 8.

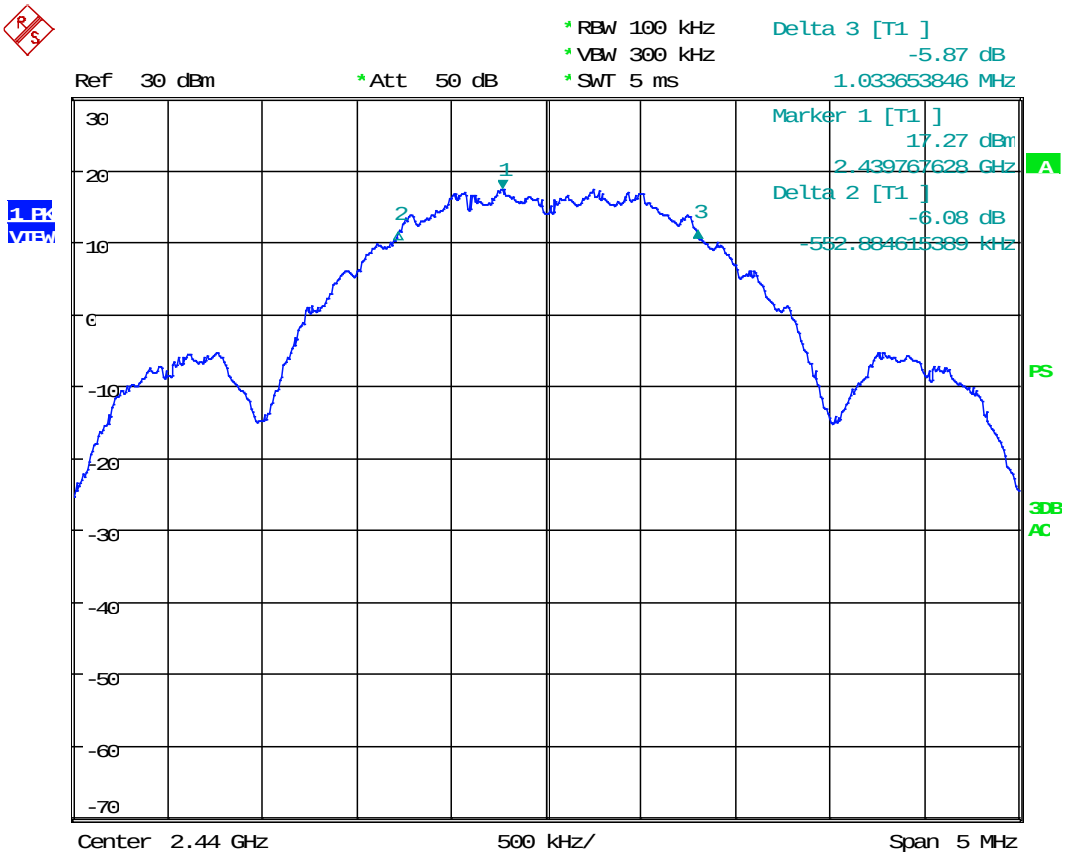
a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 × RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Channel	Frequency(MHz)	6 dB Bandwidth(kHz)
11	2405	1594.6
18	2440	1586.5
26	2480	1586.5

6 dB Bandwidth, Channel 11:



6 dB Bandwidth, Channel 18:



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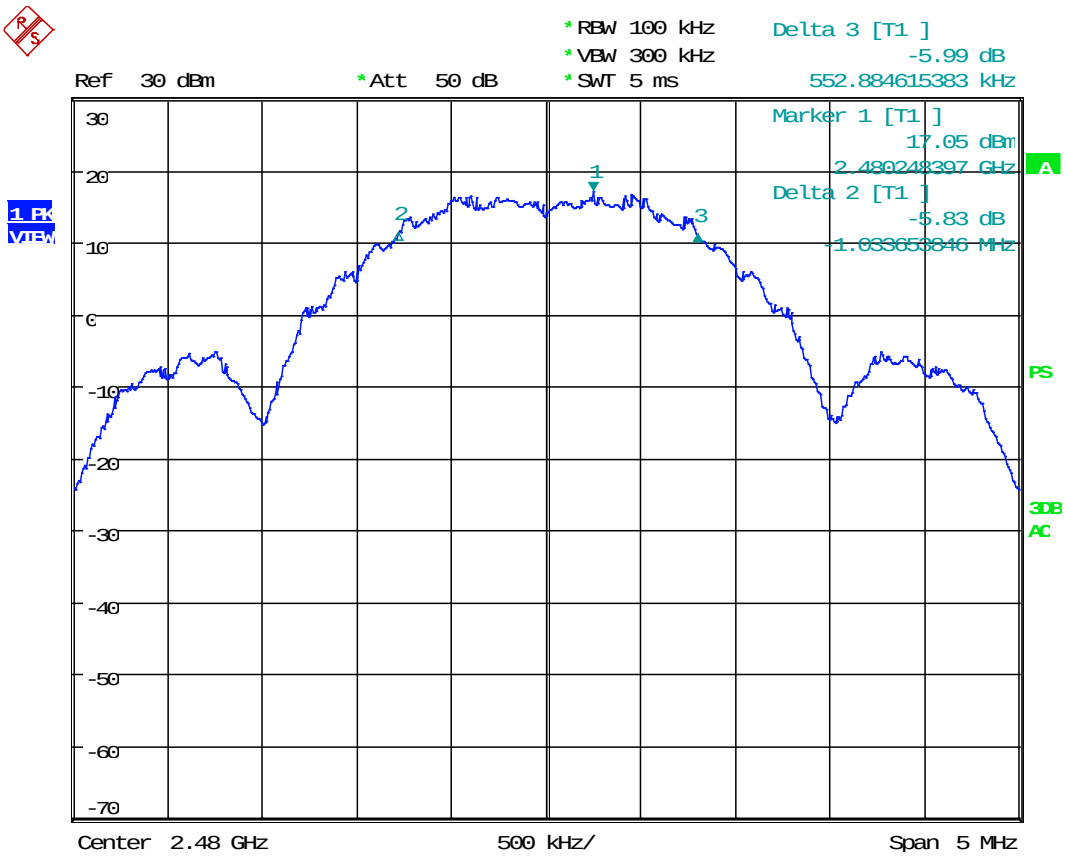
6 dB Bandwidth, Channel 26:



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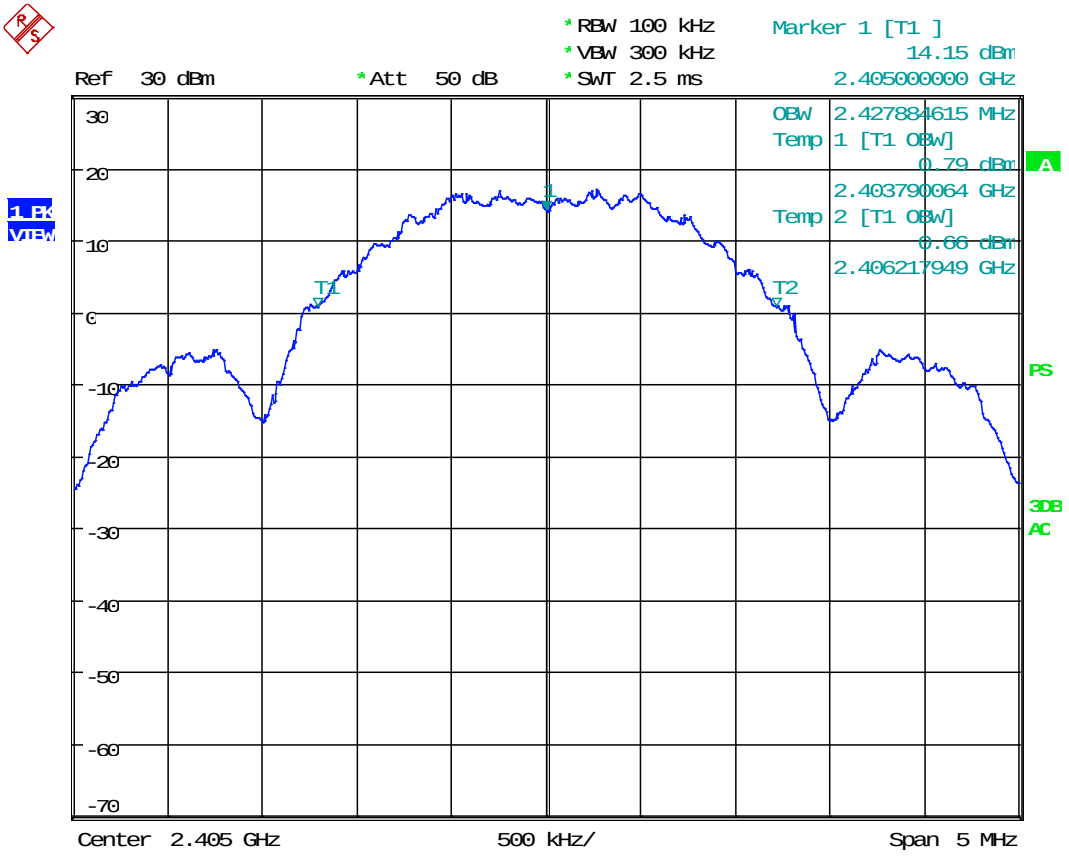
3.2 99% (Occupied Channel) Bandwidth

Performance Criterion: The 99% Bandwidth (OBW) of each channel carrier will fall within the 5MHz nominal bandwidth of the corresponding channel.

Channel	Frequency(MHz)	99% Bandwidth(MHz)
11	2405	2.428
18	2440	2.396
26	2480	2.412

99% Bandwidth, Channel 11:



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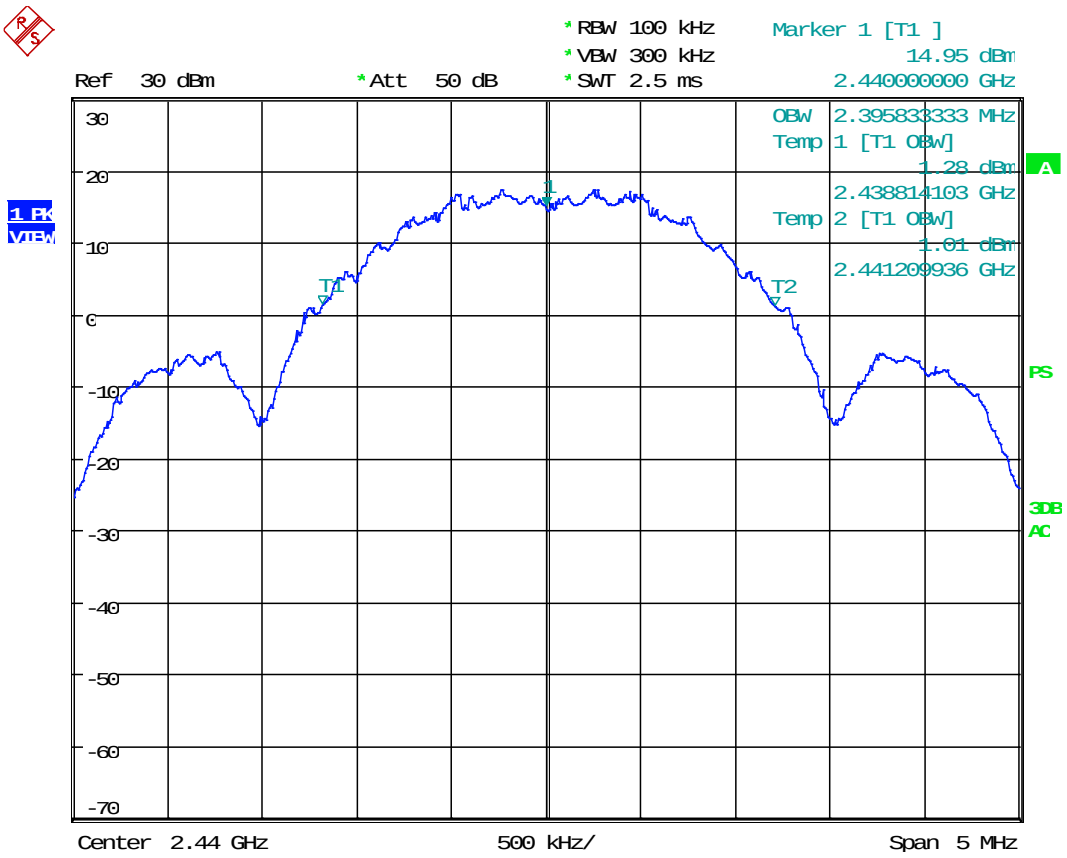
99% Bandwidth, Channel 18:



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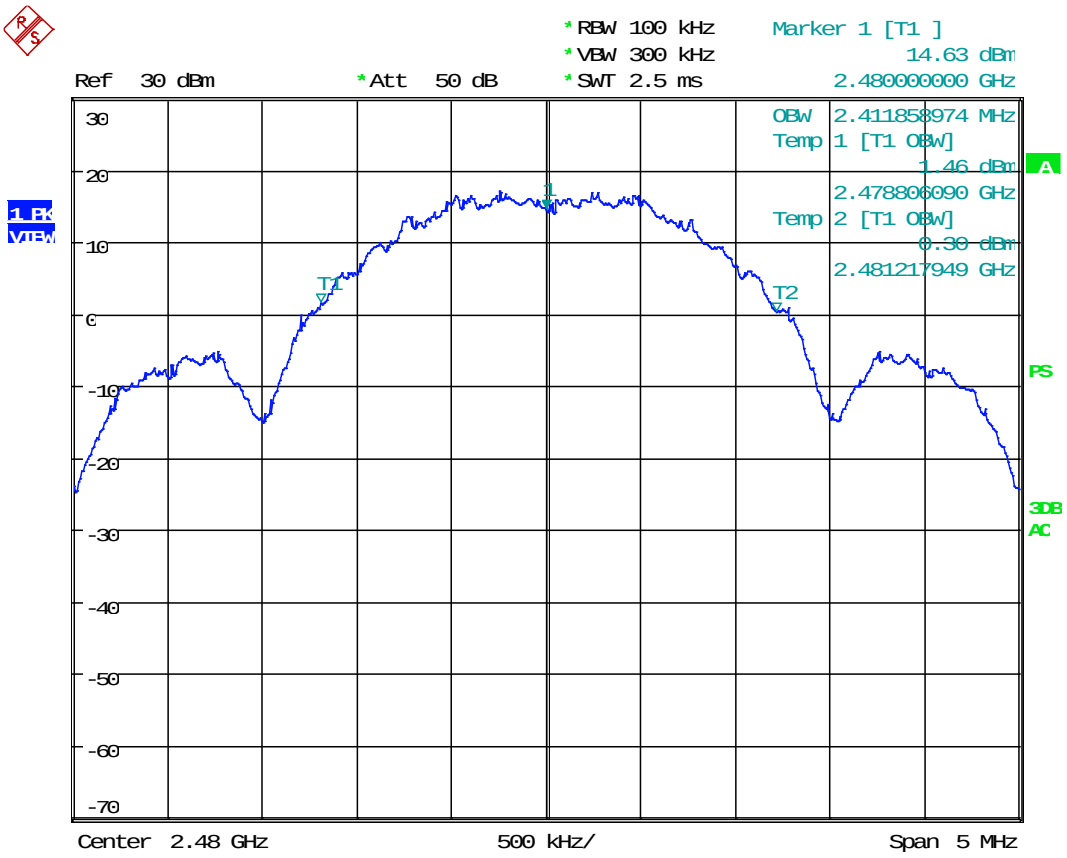
99% Bandwidth, Channel 26:



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3.3 Power Output

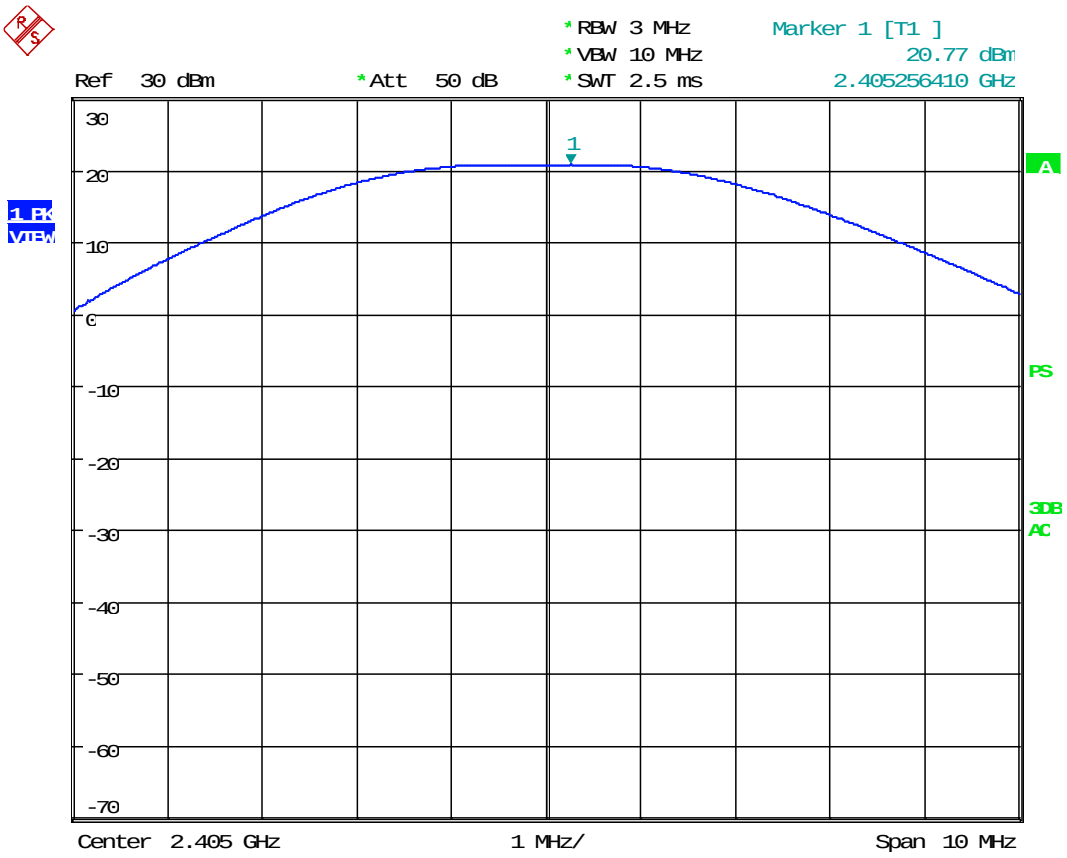
Criterion: The maximum peak conducted output power shall not exceed 1 Watt or 30 dBm

Test Procedure: Per 558074 D01 DTS Meas Guidance v03r02 § 9.1.1

a) Set the RBW ≥ *DTS bandwidth*.
b) Set VBW ≥ 3 × RBW.
c) Set span ≥ 3 x RBW
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

Channel	Frequency(MHz)	Output Power Level Setting Command (decimal)	Measured Power	
			dBm	mW
11	2405	253	20.8	119.40
18	2440	253	20.9	122.46
24	2470	253	20.8	120.23
25	2475	253	20.7	118.03
26	2480	236	4.1	2.57

Power Output, Channel 11:



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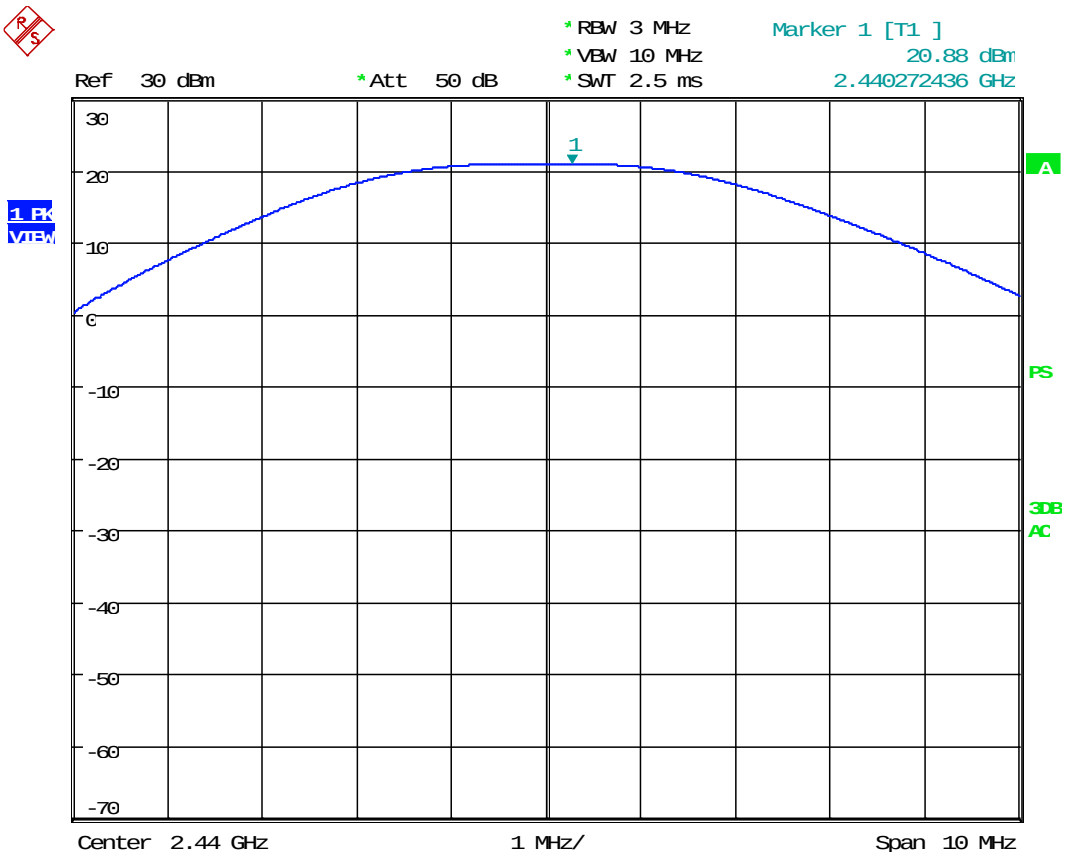
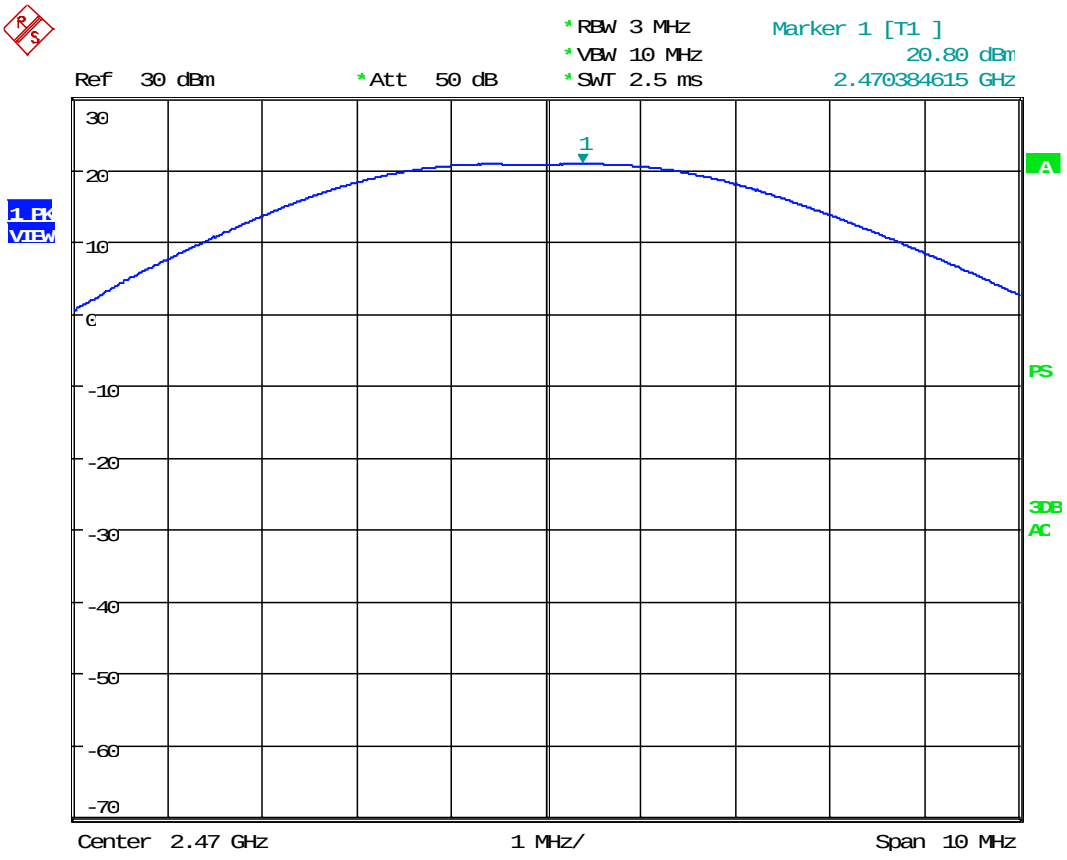
Power Output, Channel 18:



Power Output, Channel 24:



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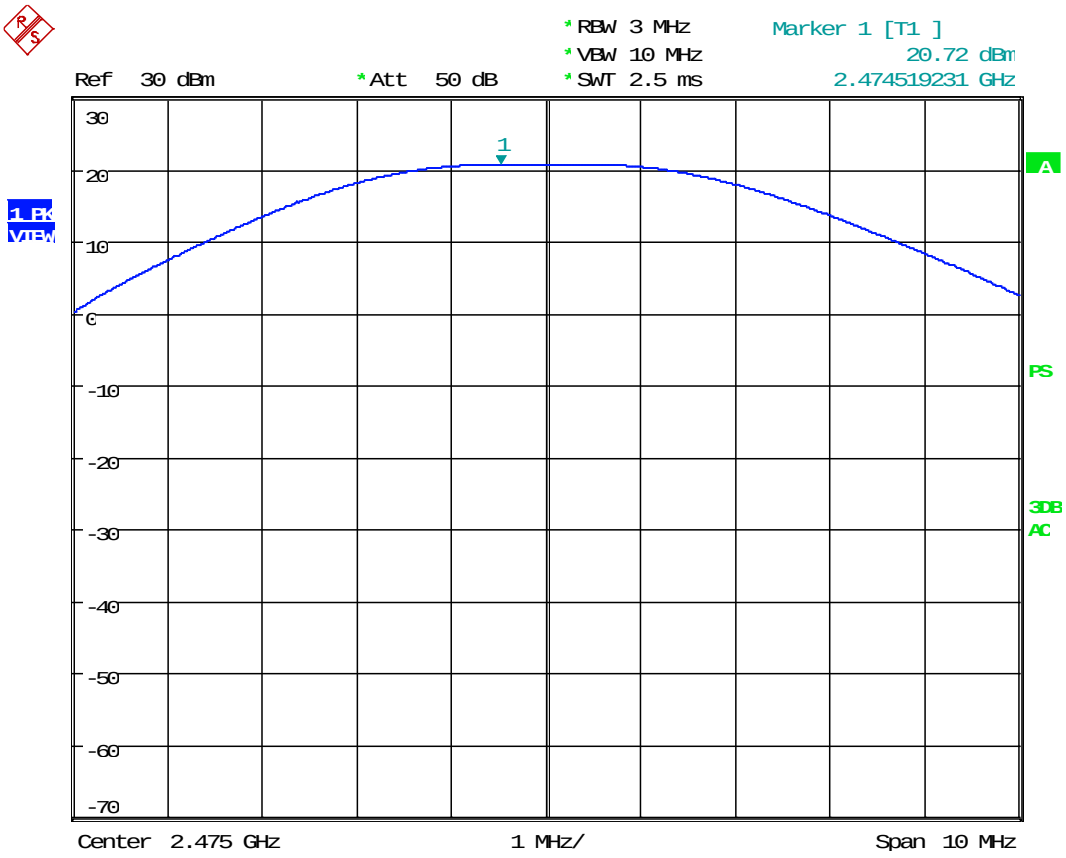
Power Output, Channel 25:



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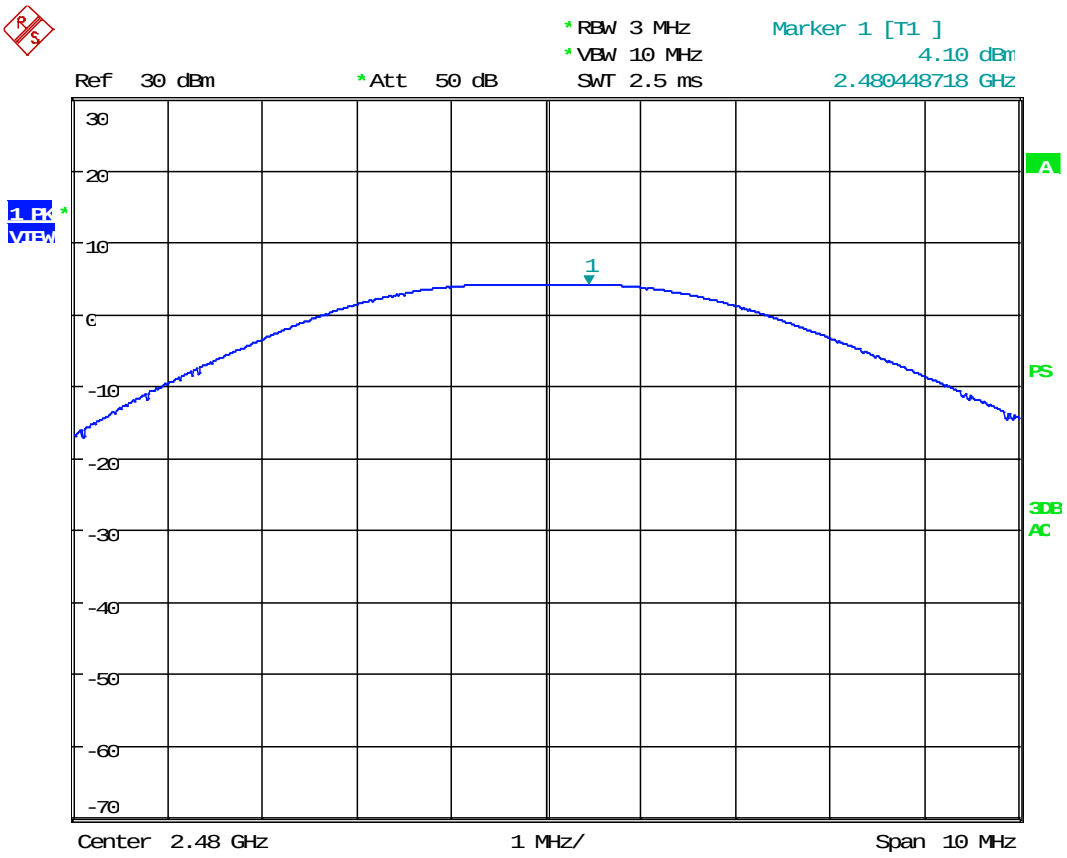
Power Output, Channel 26:



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3.4 Band Edge Conducted

Criterion: In any 100 kHz bandwidth outside the frequency band, the RF power shall be at least 20 dB below that in the 100 kHz bandwidth within the band.

Test Procedure: Per 558074 D01 DTS Meas Guidance v03r02 § 11

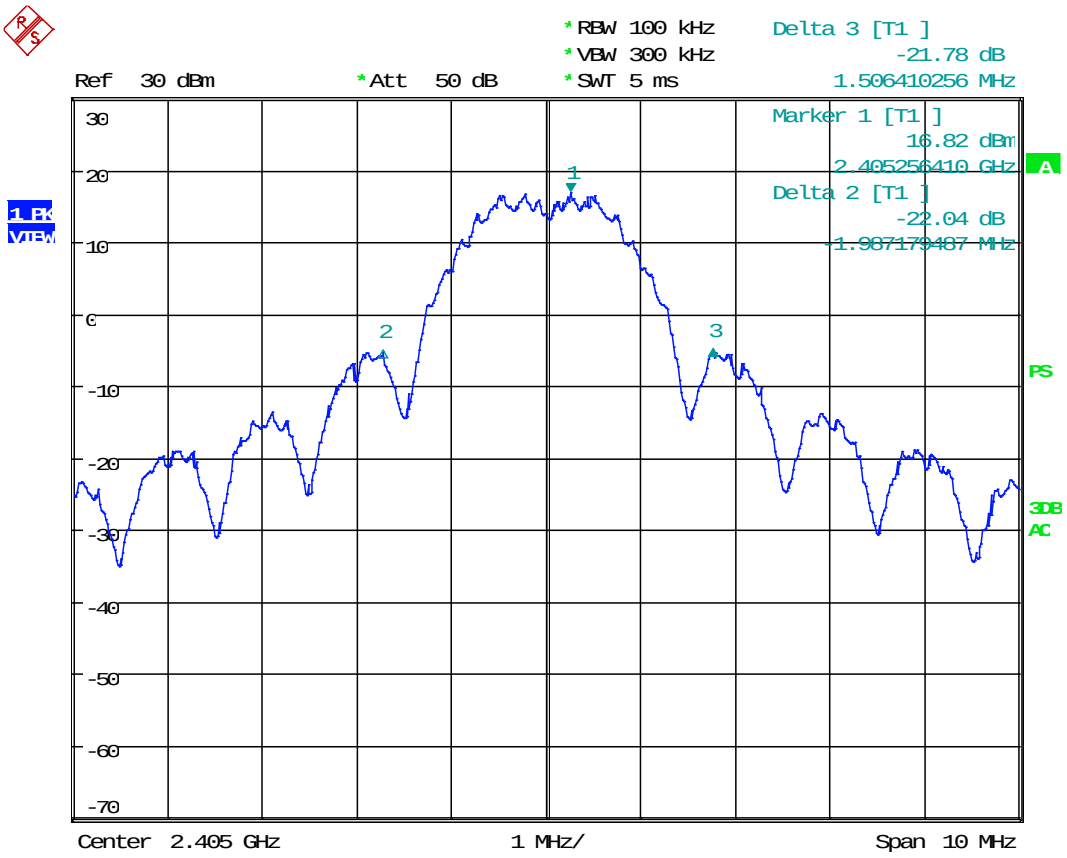
The DTS rules specify that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions:

a) If the maximum peak conducted output power procedure was used to demonstrate compliance as described in 9.1, then the peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz (*i.e.*, 20 dBc).

b) If maximum conducted (average) output power was used to demonstrate compliance as described in 9.2, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz (*i.e.*, 30 dBc).

c) In either case, attenuation to levels below the 15.209 general radiated emissions limits is not required.

Band Edge, Channel 11:



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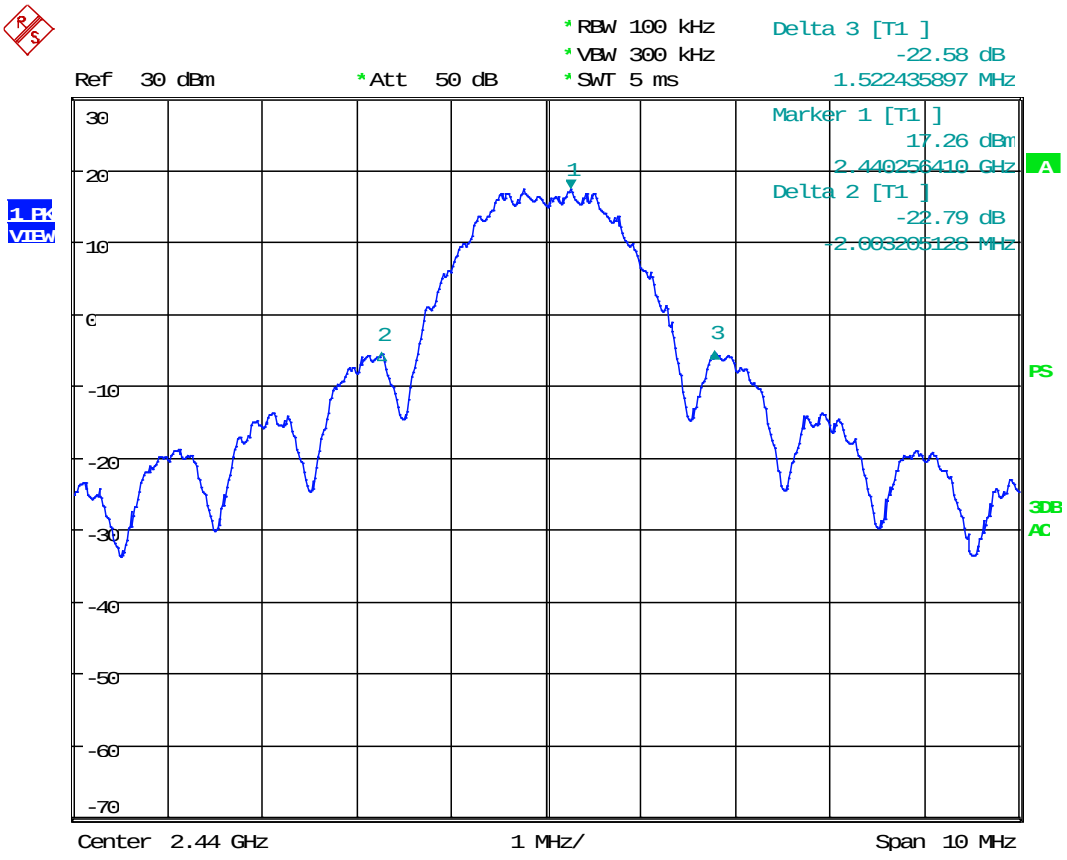
Band Edge, Channel 18:



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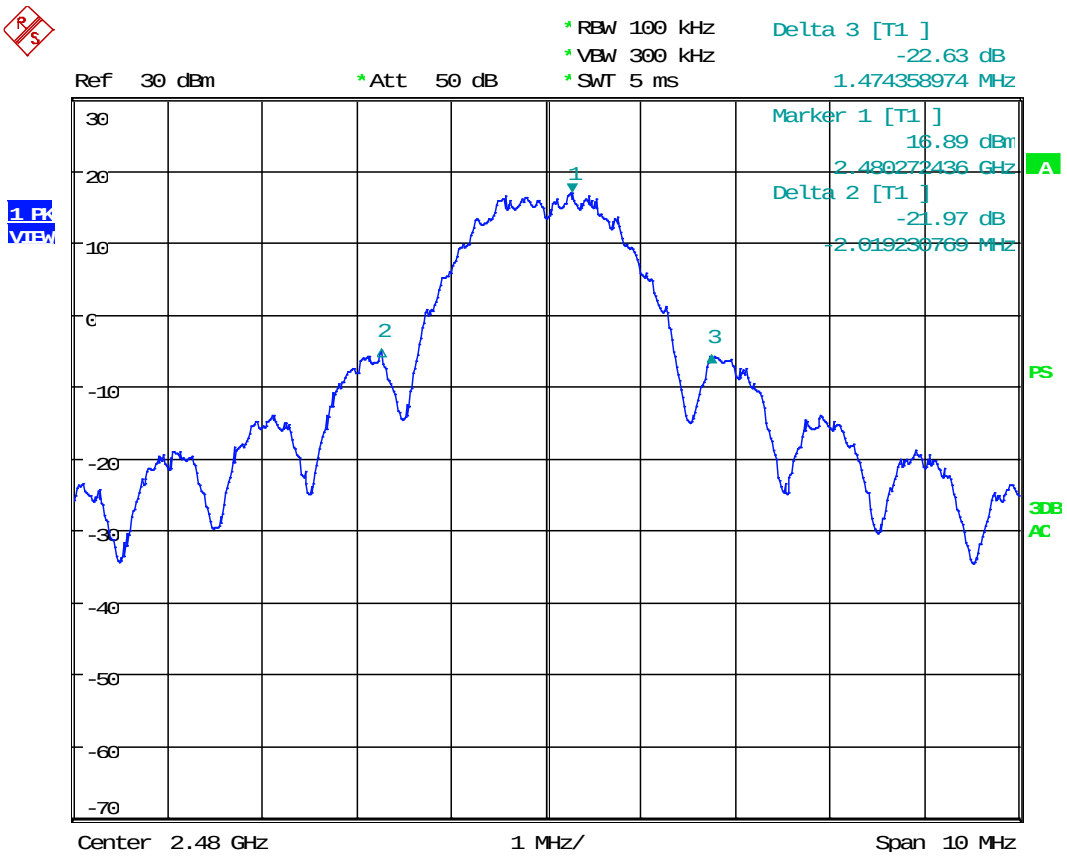
Band Edge, Channel 26:

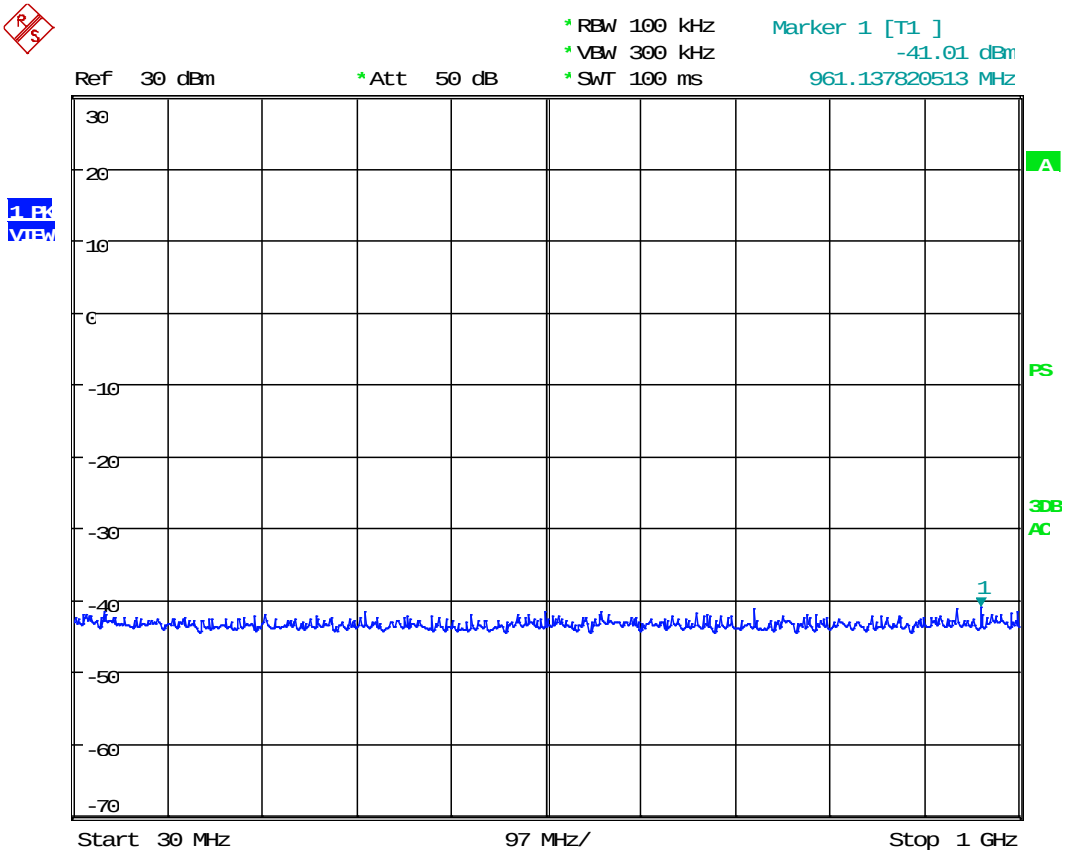


3.5 Conducted Spurious Emissions

Criterion: In any 100 kHz bandwidth outside the frequency band, the RF power shall be at least 20 dB below that in the 100 kHz bandwidth within the band.

Test Procedure: Per 558074 D01 DTS Meas Guidance v03r02 § 11

Conducted Spurious Emission, 30MHz to 1GHz, Channel 11:



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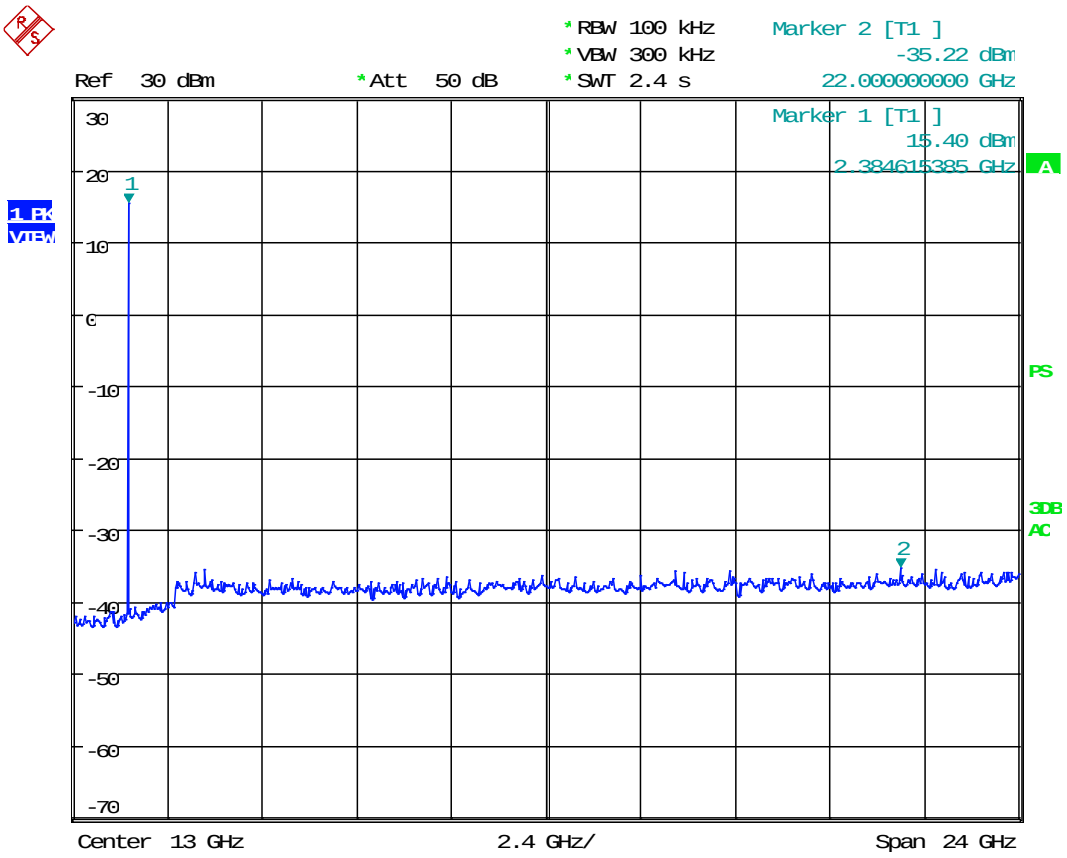
Conducted Spurious Emission, 1GHz to 25GHz, Channel 11:



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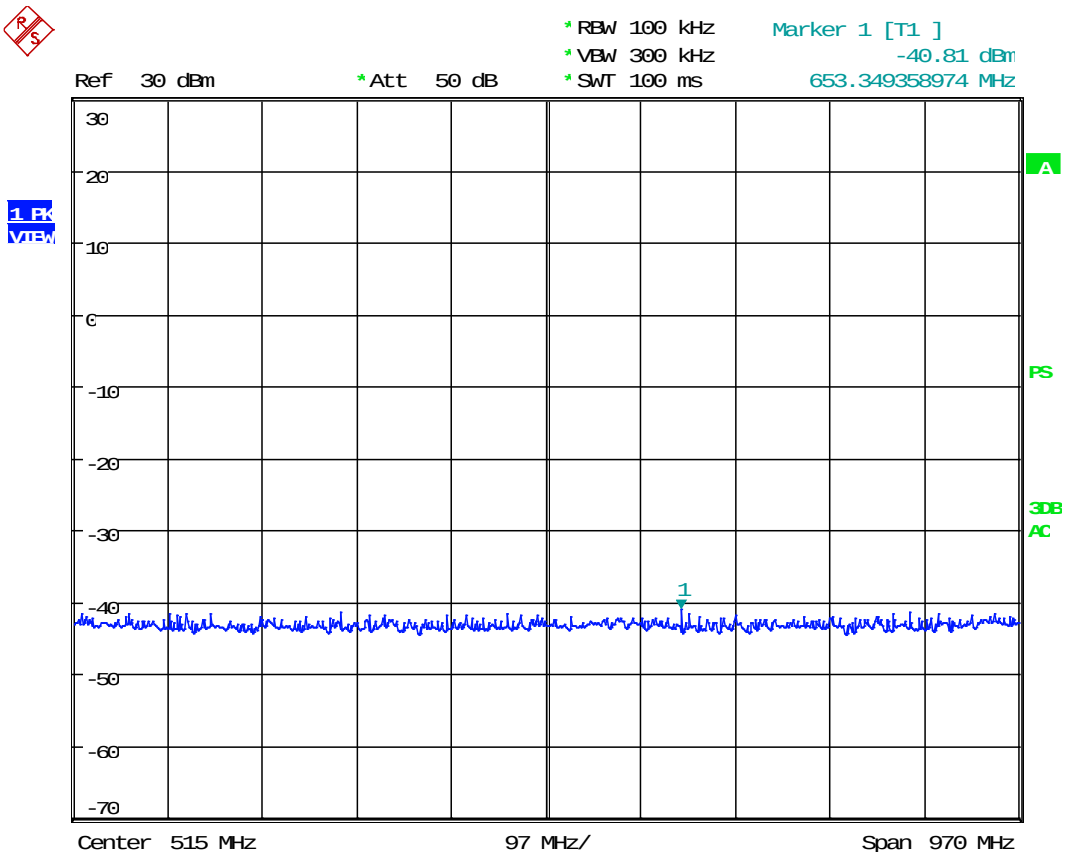
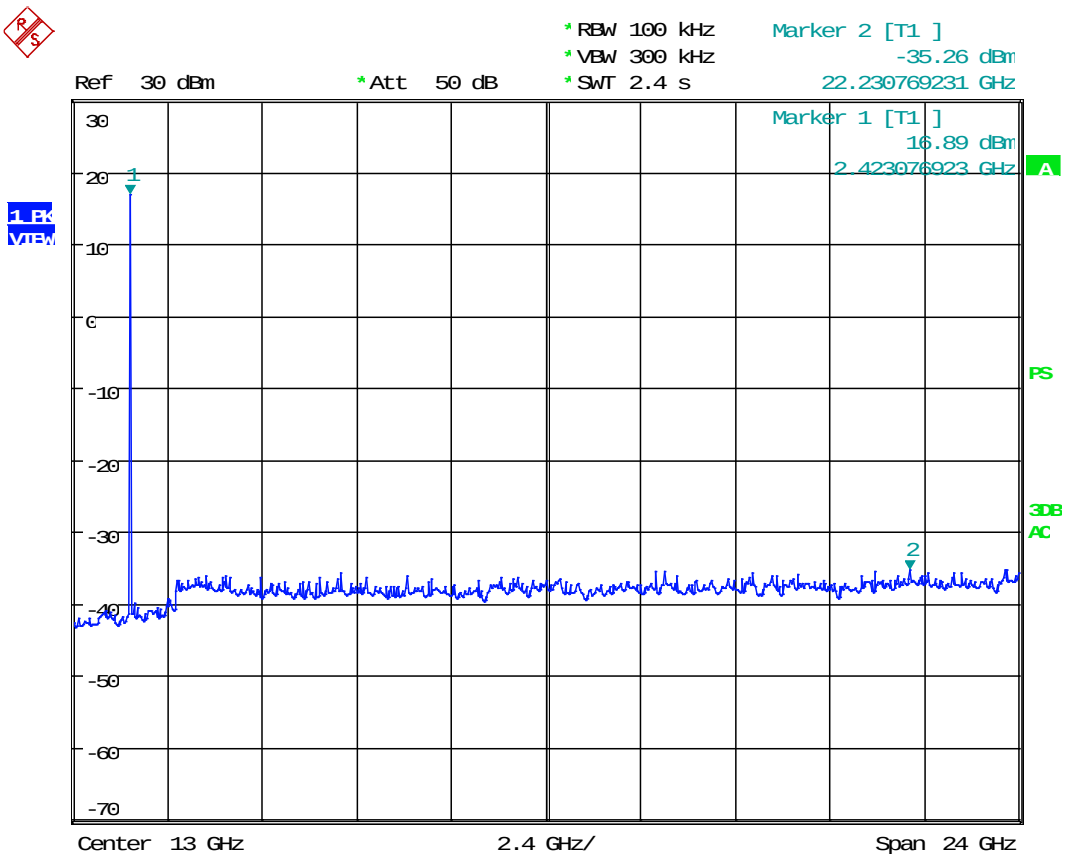
Conducted Spurious Emission, 30MHz to 1GHz, Channel 18:



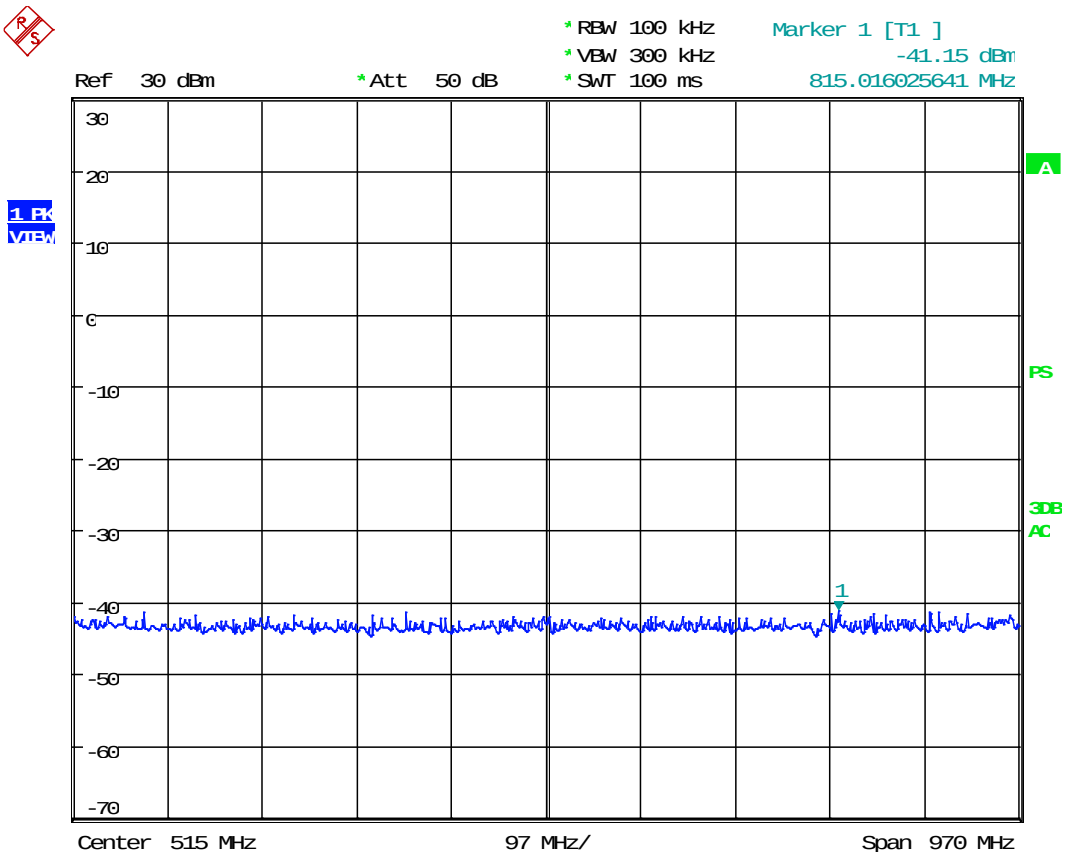
Date: 31.AUG.2016 12:39:19

Conducted Spurious Emission, 1GHz to 25GHz, Channel 18:



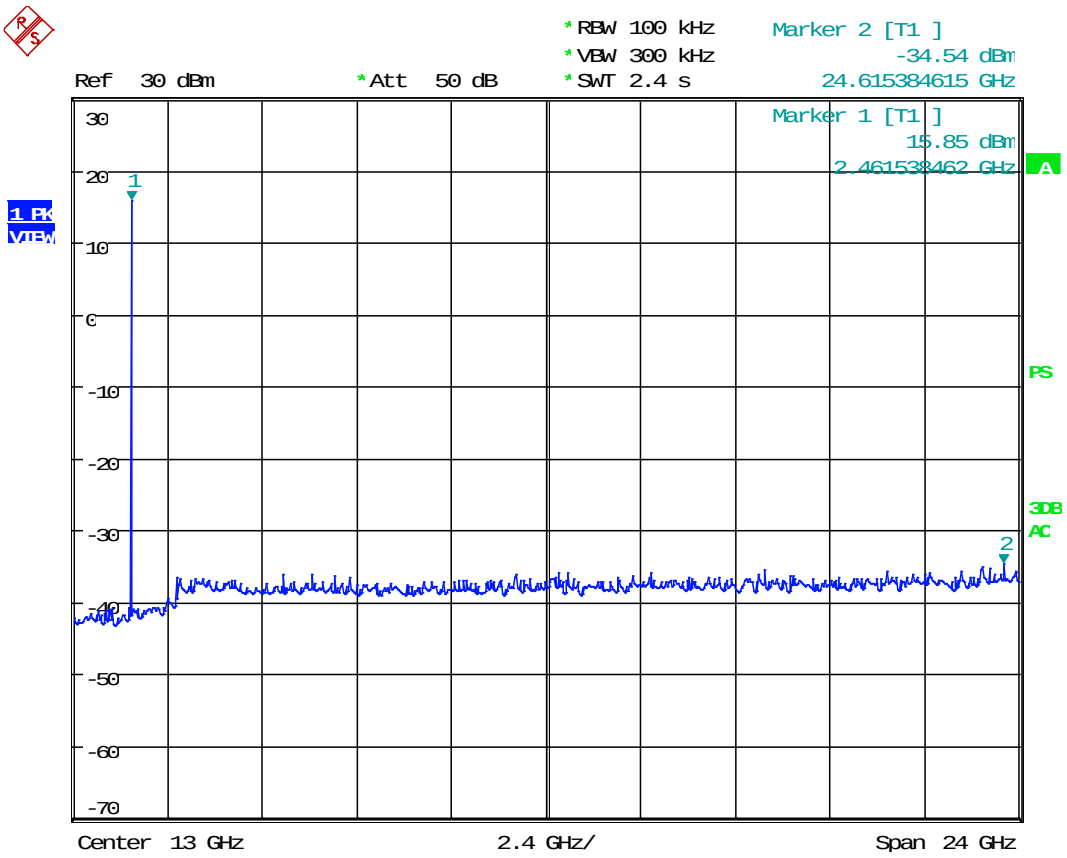
Date: 31.AUG.2016 12:54:56

Conducted Spurious Emission, 30MHz to 1GHz, Channel 26:



Date: 31.AUG.2016 12:41:48

Conducted Spurious Emission, 1GHz to 25GHz, Channel 26:



Date: 31.AUG.2016 12:57:00

3.6 Power Spectral Density

Criterion: The Power Spectral Density shall not be greater than 8dBm in any 3 KHz band.

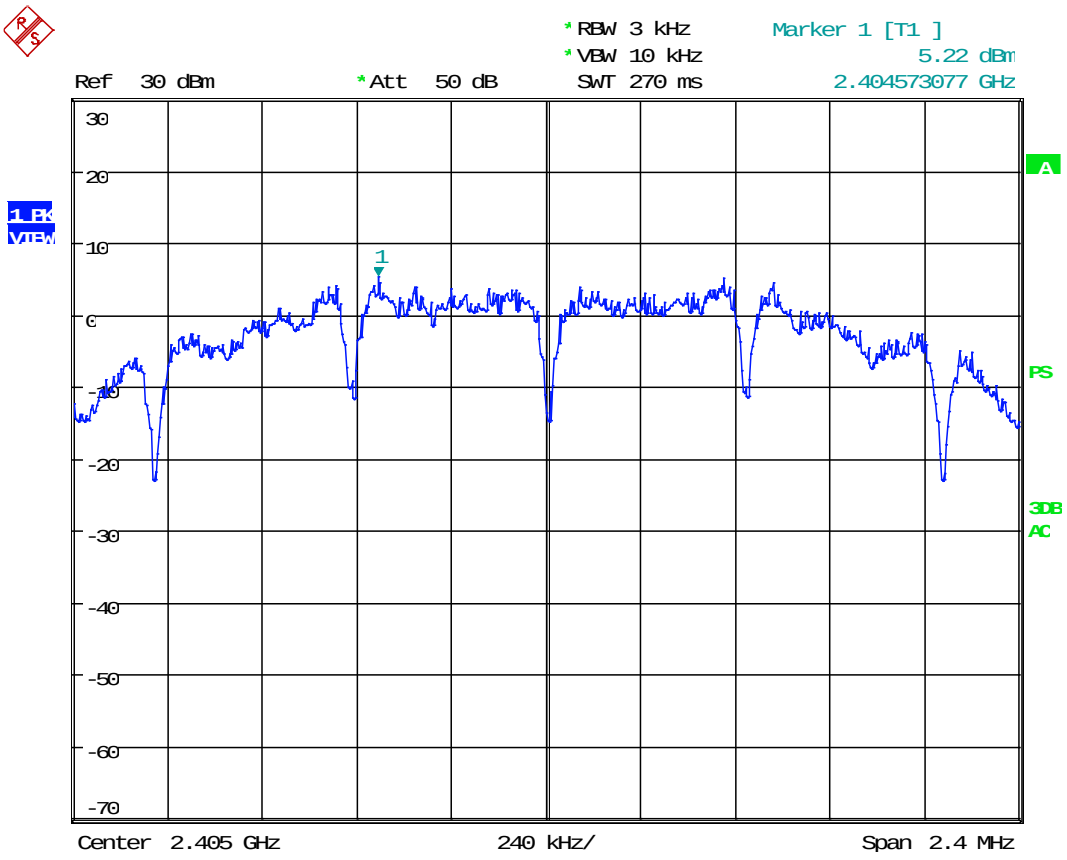
Test Procedure: Per 558074 D01 DTS Meas Guidance v03r02 § 10.2

Set analyzer center frequency to DTS channel center frequency.

b) Set the span to 1.5 times the *DTS bandwidth*.
c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ 3 × RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

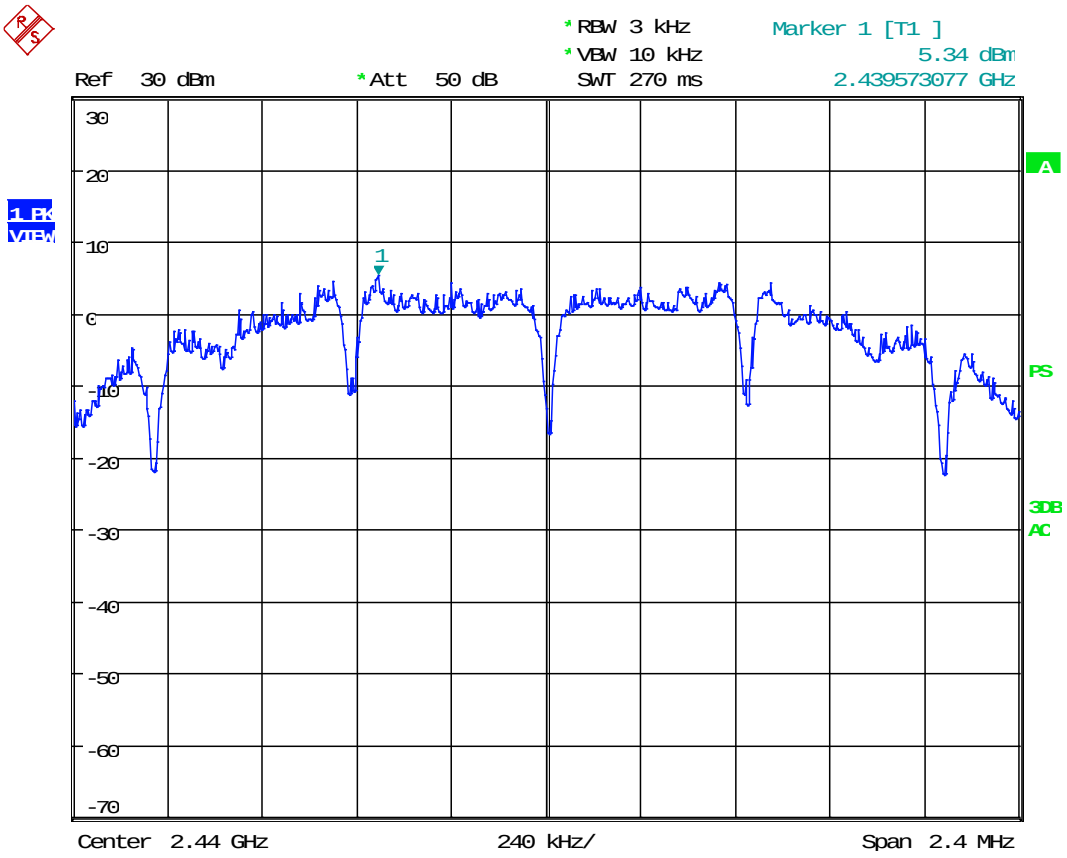
Channel	Frequency(MHz)	Power Spectral Density (dBm)
11	2405	5.22
18	2440	5.34
26	2480	5.16

Power Spectral Density, Channel 11:



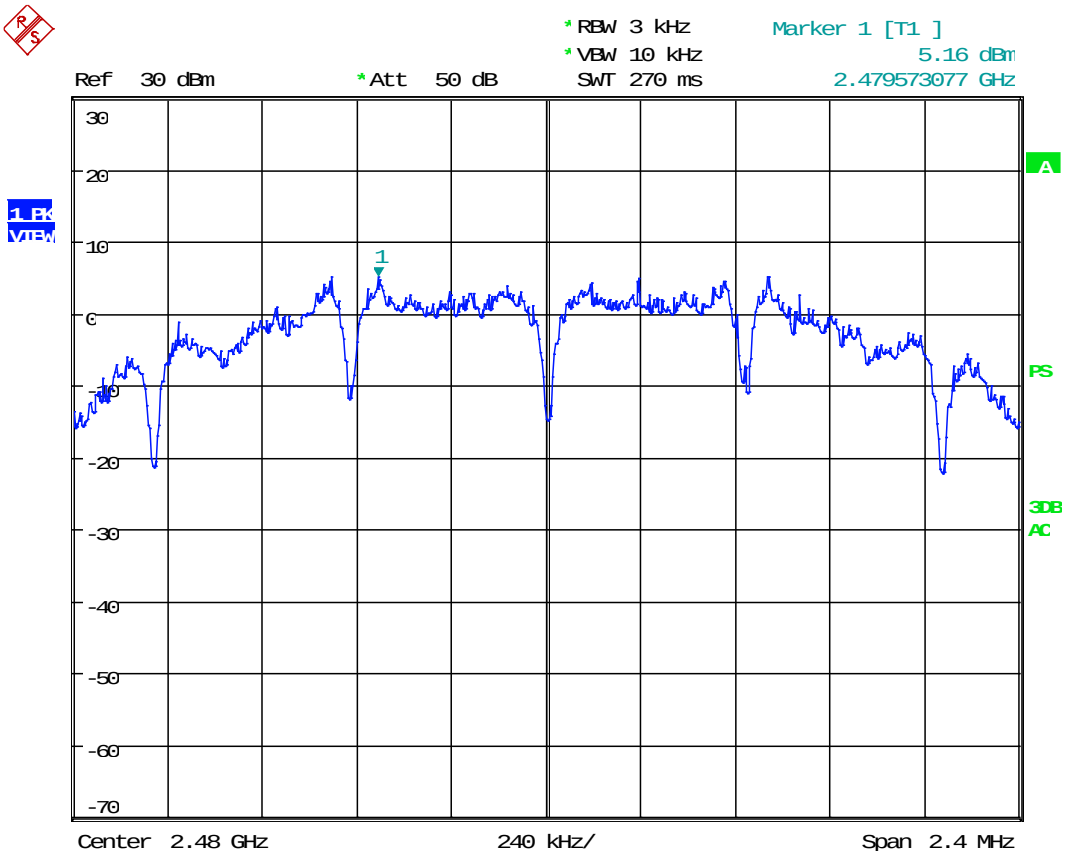
Date: 31.AUG.2016 14:55:45

Power Spectral Density, Channel 18:



Date: 31.AUG.2016 15:11:14

Power Spectral Density, Channel 26:



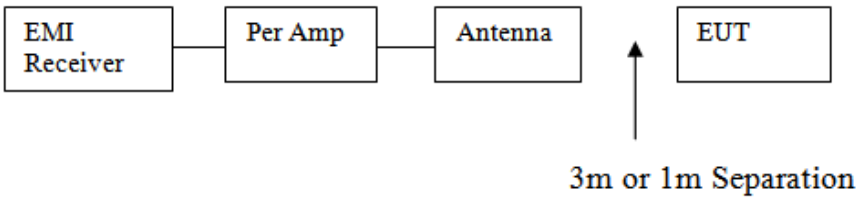
Date: 31.AUG.2016 15:05:55

3.7 Radiated Spurious Emissions

Criterion: Radiated spurious emissions which fall in the restricted bands must comply with the radiated emission limits specified in FCC § 15.209(a) and Table 2 of IC RSS-Gen.

Test Procedure: Per 558074 D01 DTS Meas Guidance v03r02 § 11
Radiated spurious emission was performed from 30 MHz to the tenth harmonics of the carrier. For each scan of radiated emission measurement, the procedures for maximizing emissions were followed. The EUT was rotated and antenna height was varied between 1meter (m) and 4m in order to maximize the observed levels. Measurements in both horizontal and vertical polarities were made and the data was recorded. All radiated emission measurements, up to 18 GHz, were performed at 3m distance between an antenna and the EUT. All radiated emission measurements, above 18 GHz, were performed at 1m distance between an antenna and the EUT.

Block Diagram:

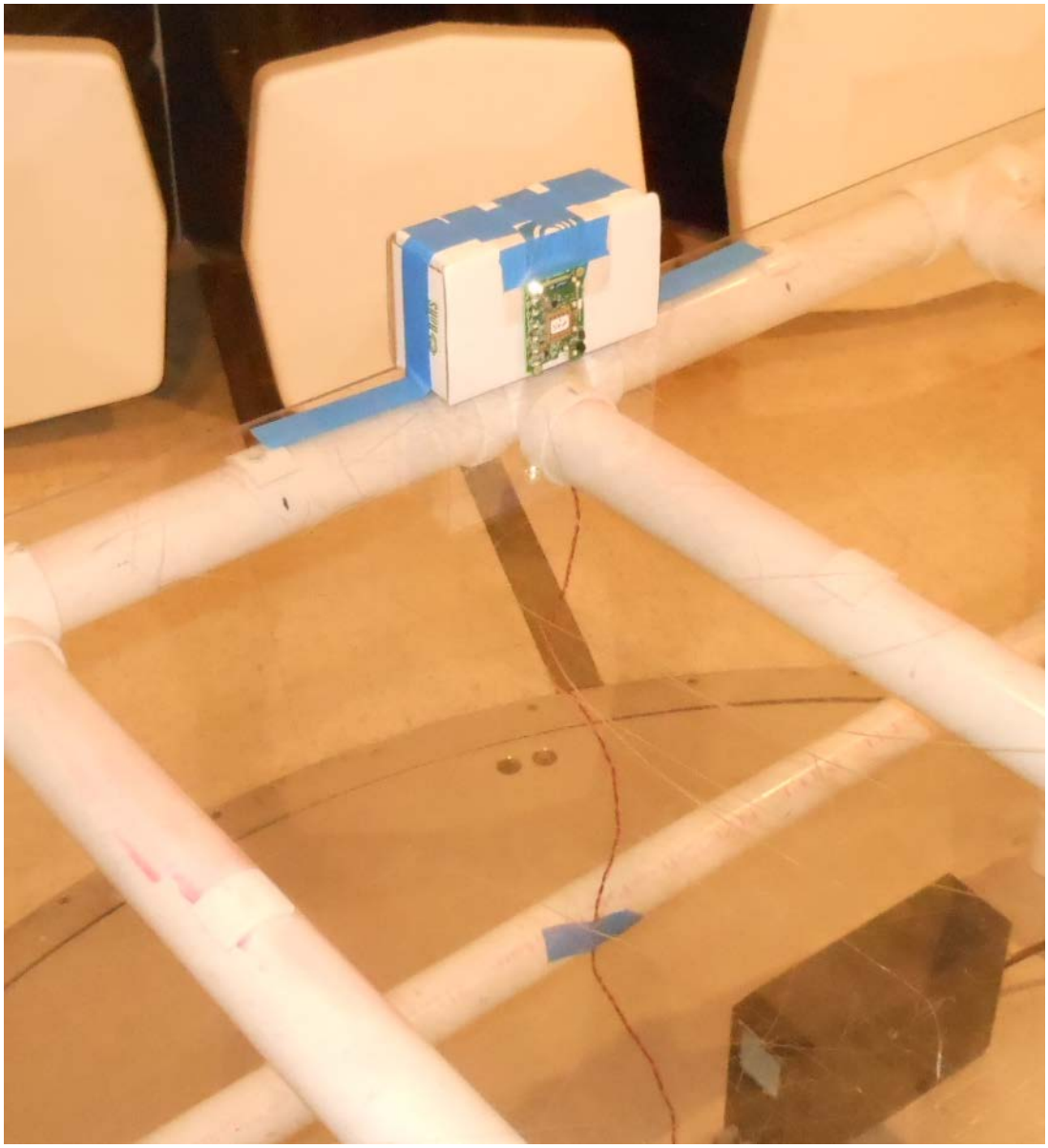


The peak levels of radiated emissions above 1 GHz was measured with a resolution bandwidth (RBW) of 1 MHz and a Video Band Width (VBW) of 3 MHz. Duty Cycle Correction Factor (DCCF) was applied to the Average level readings at UBE, harmonic and LBE frequencies.

Over the 30MHz to 18GHz frequency range, the EUT was distanced 3 meters from the receive antenna (bilog or double ridge).

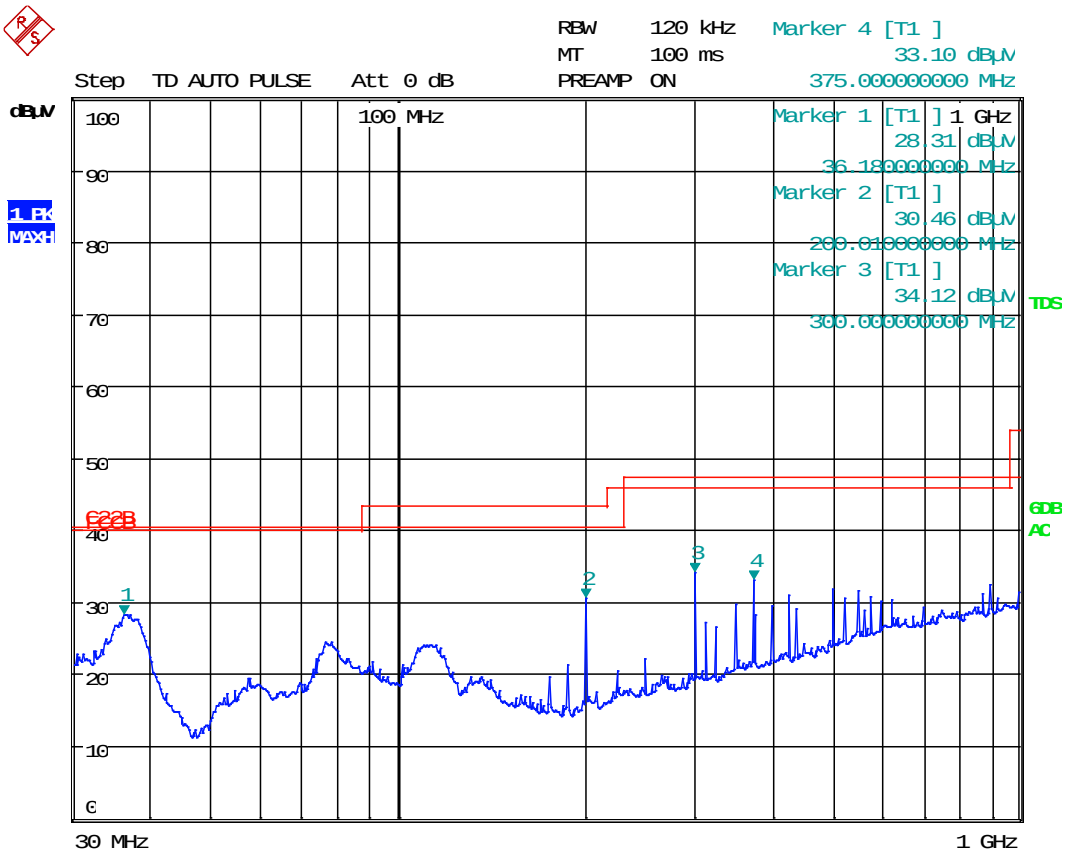
For all applications, the EUT is intended to be mounted on a vertical wall surface, with its PCB flat against the plane of the wall. The integral antenna is in the plane of the PCB, near and parallel to its upper edge, as seen in the close-up photo of the PCB:

The EUT was positioned on the test table and tested only in the orientation seen in the Figures below (ie, PCB edge with integral antenna pointing up):



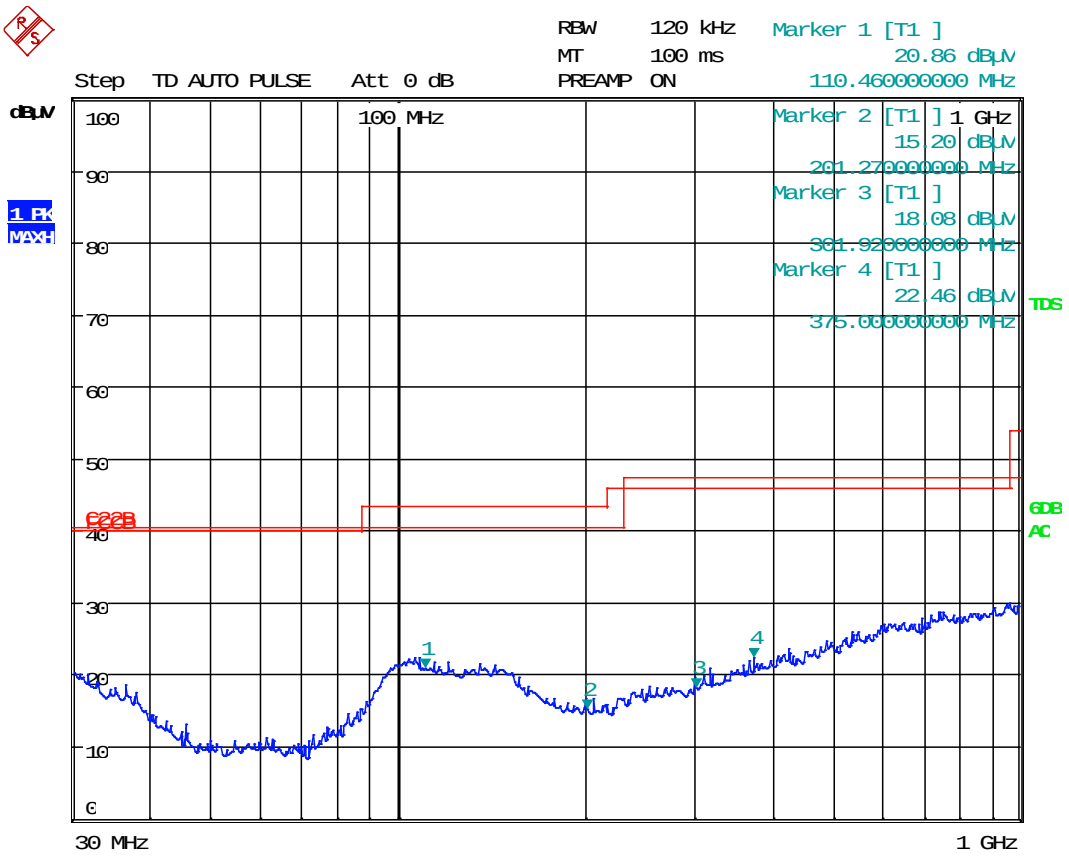
Sample Plots

30MHz-1GHz Vertical:



Date: 1.SEP.2016 16:12:18

30MHz-1GHz Horizontal:



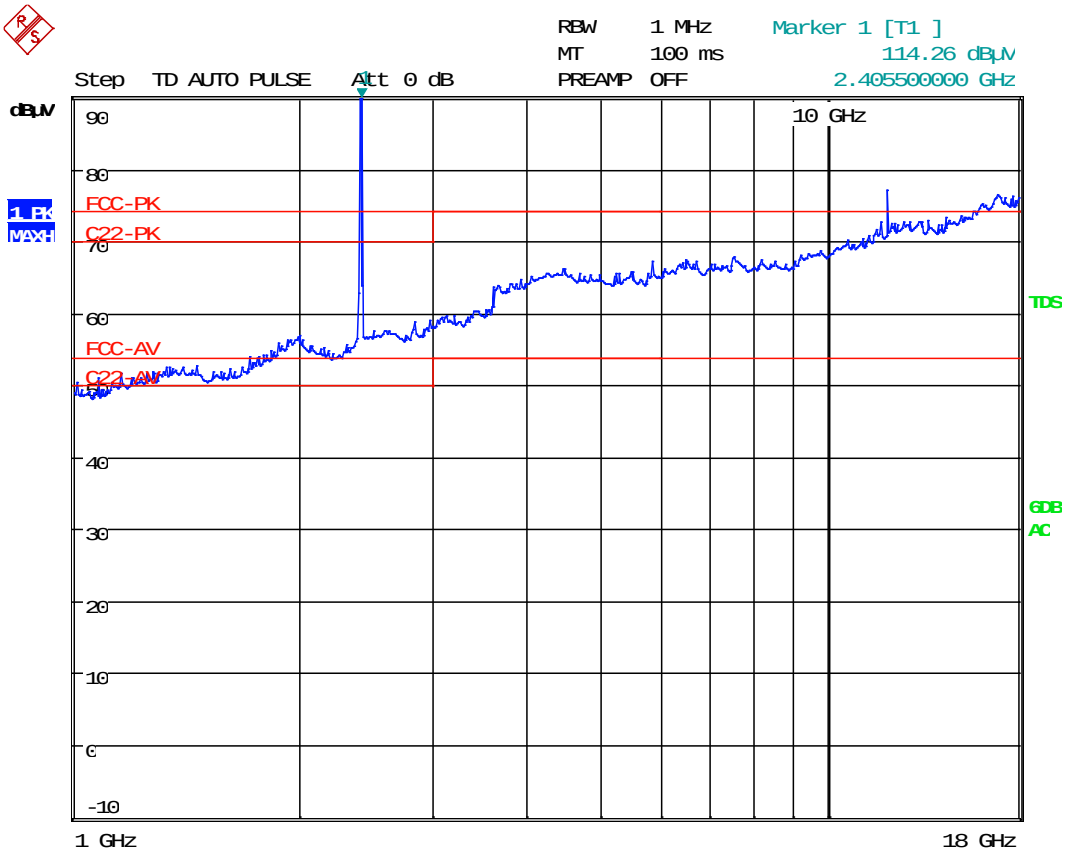
Date: 1.SEP.2016 16:20:01

Radiated Emissions (30MHz – 1GHz)

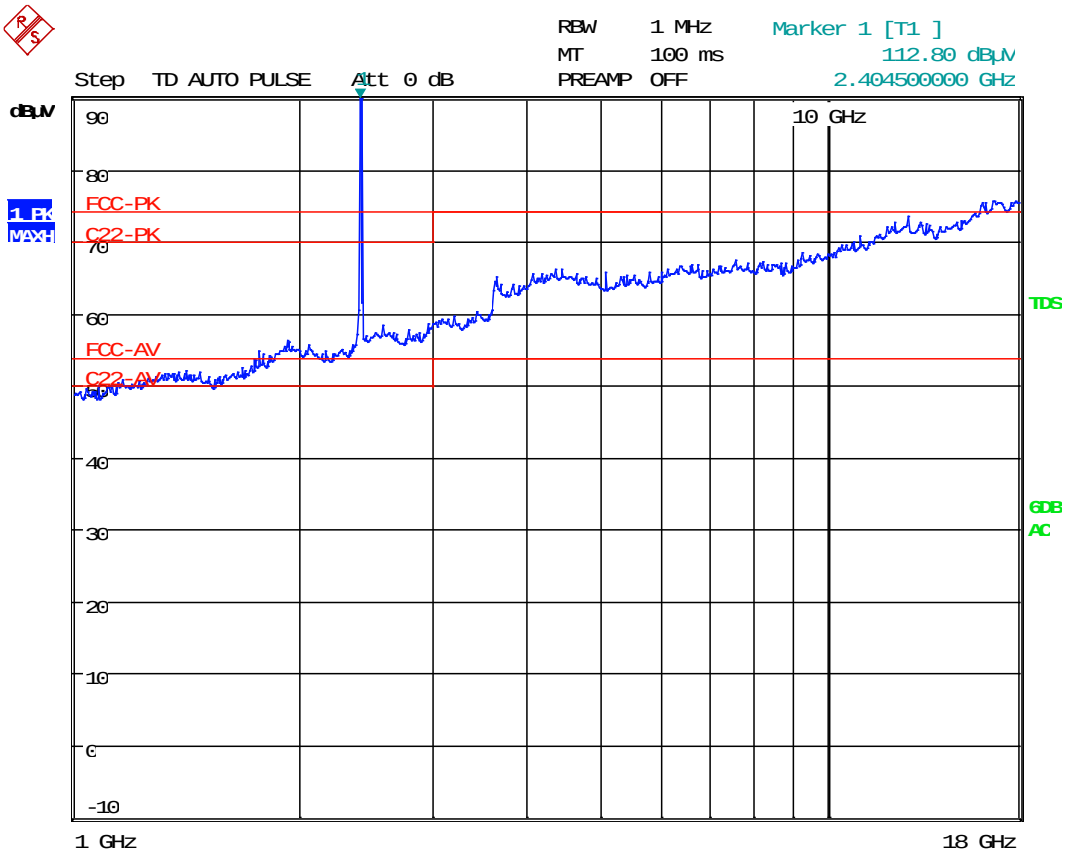
Antenna		Turntable Azimuth Angle (degrees)	Frequency (MHz)	Measured Level (dBuV/m)	FCC Class B	
Polarity	Height (cm)				Limit (dBuV/m)	Margin (dB)
v	94	277	36.6	24.9	40	15.1
v	145	176	77.49	21.9	40	18.1
v	129	268	107.46	19.1	43.5	24.4
v	102	153	200.01	28.9	43.5	14.6
v	94	49	300	33.1	46	12.9
v	95	85	375	32.2	46	13.8

Sample Plots

1GHz-18GHz Vertical: Channel 11

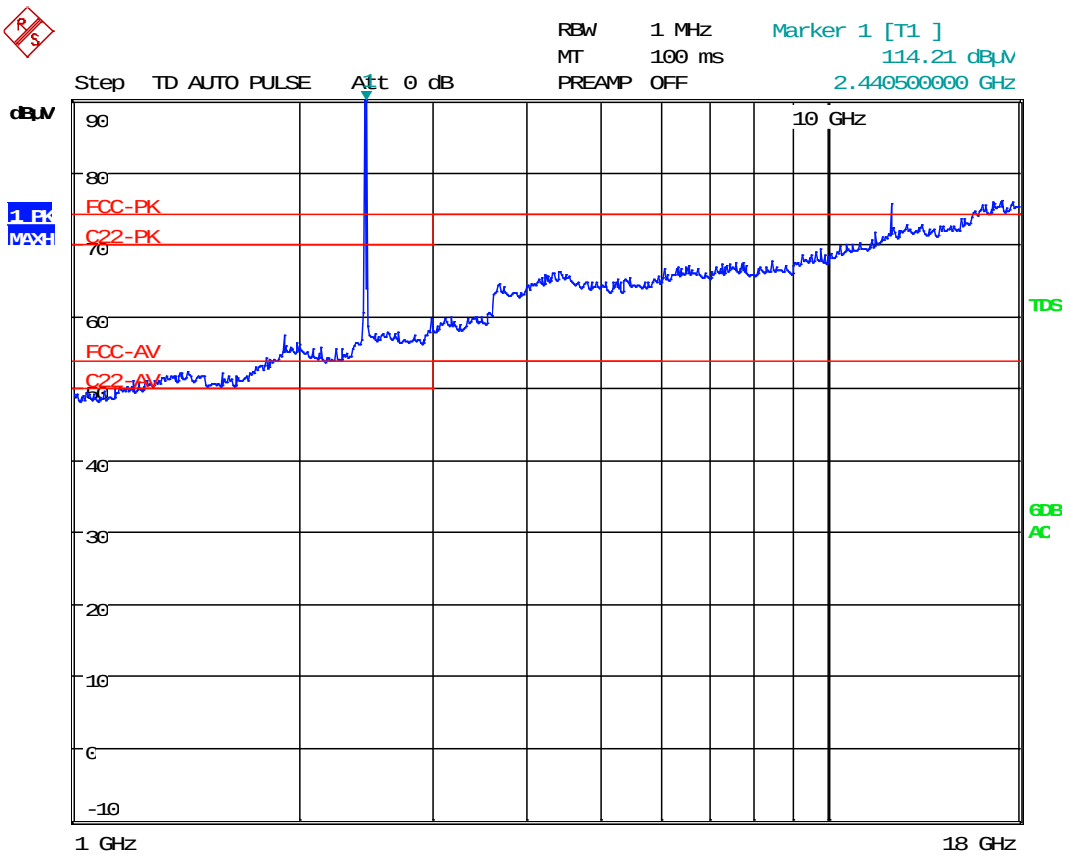


1GHz-18GHz Horizontal: Channel 11



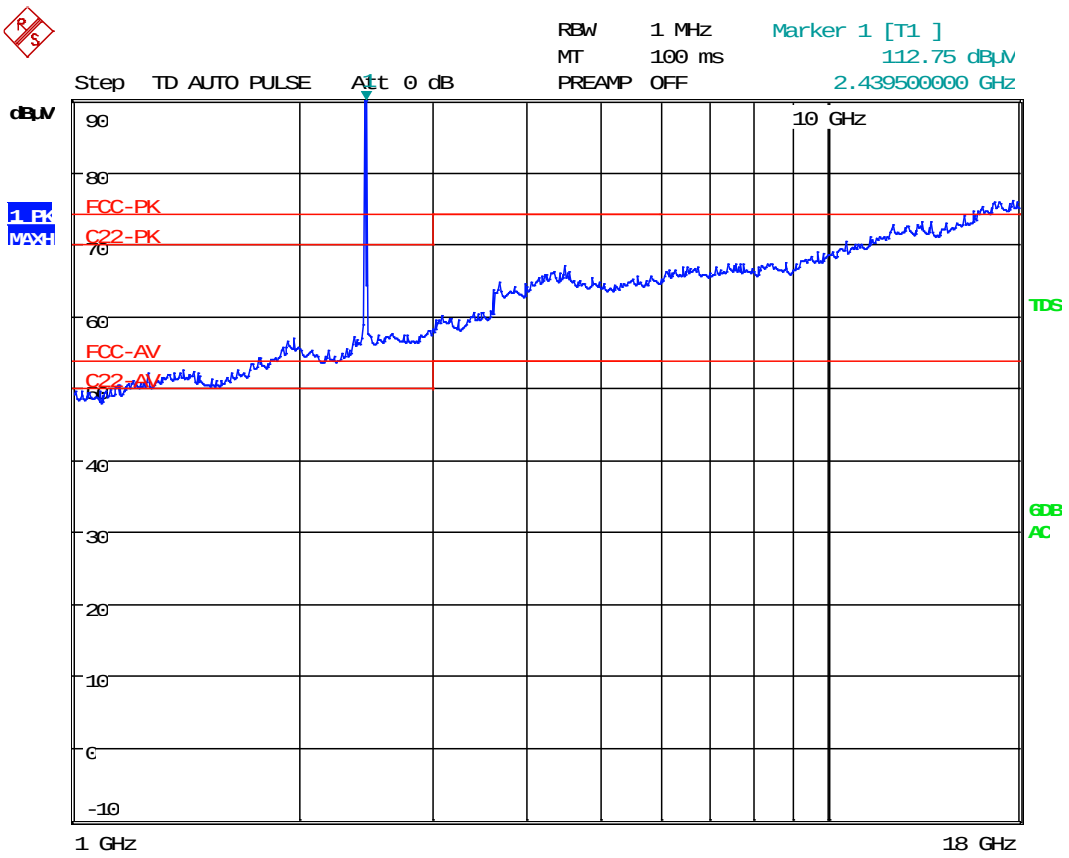
Date: 7.SEP.2016 12:29:21

1GHz-18GHz Vertical: Channel 18



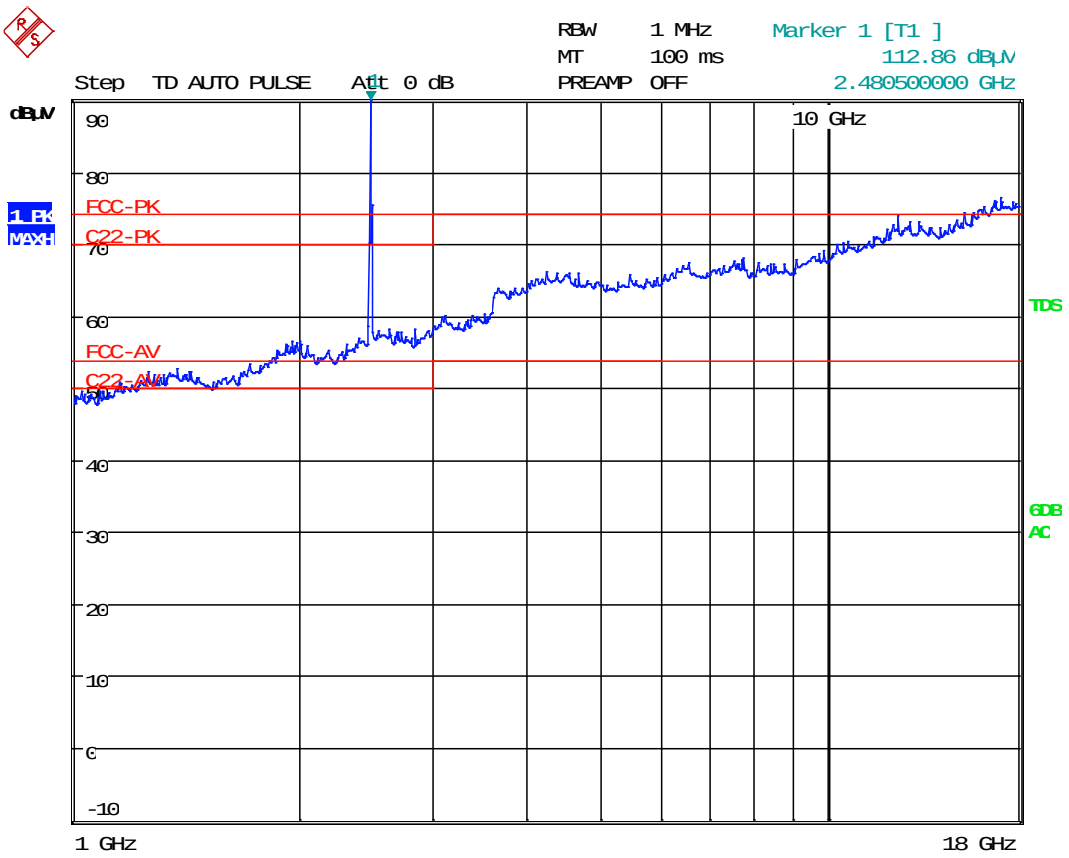
Date: 7.SEP.2016 13:13:05

1GHz-18GHz Horizontal: Channel 18



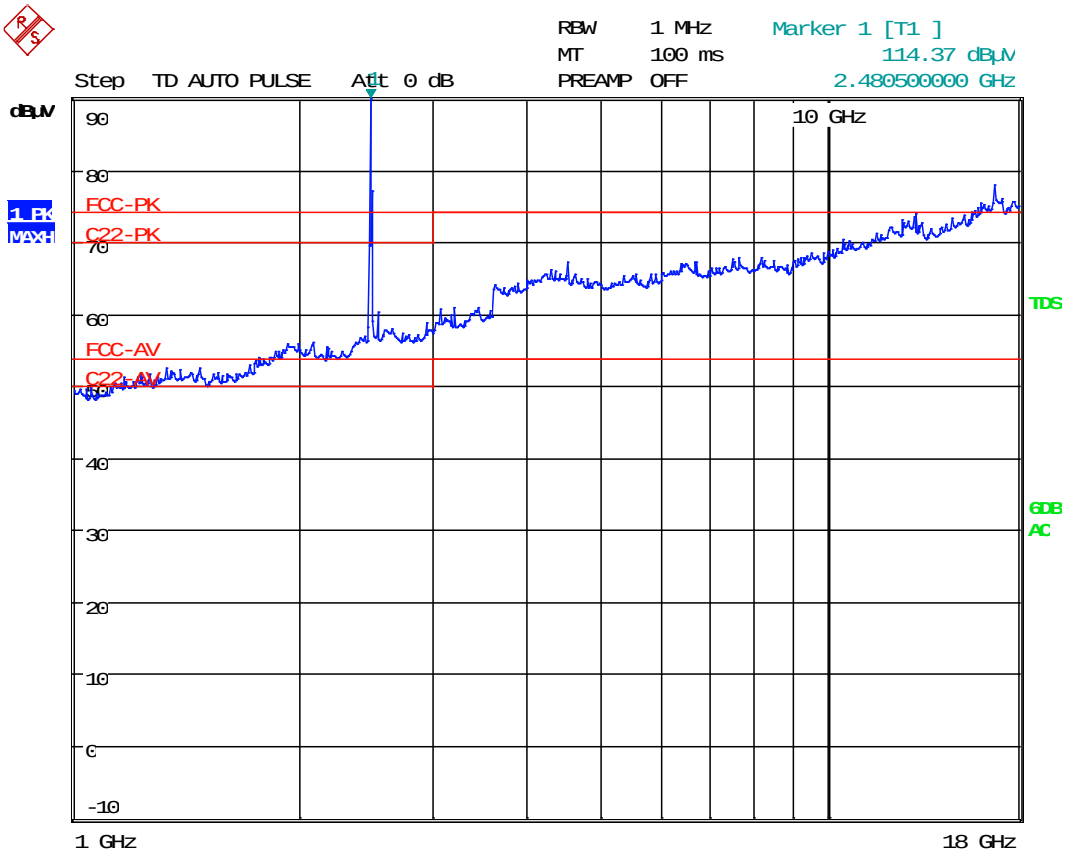
Date: 7.SEP.2016 13:09:32

1GHz-18GHz Vertical: Channel 26



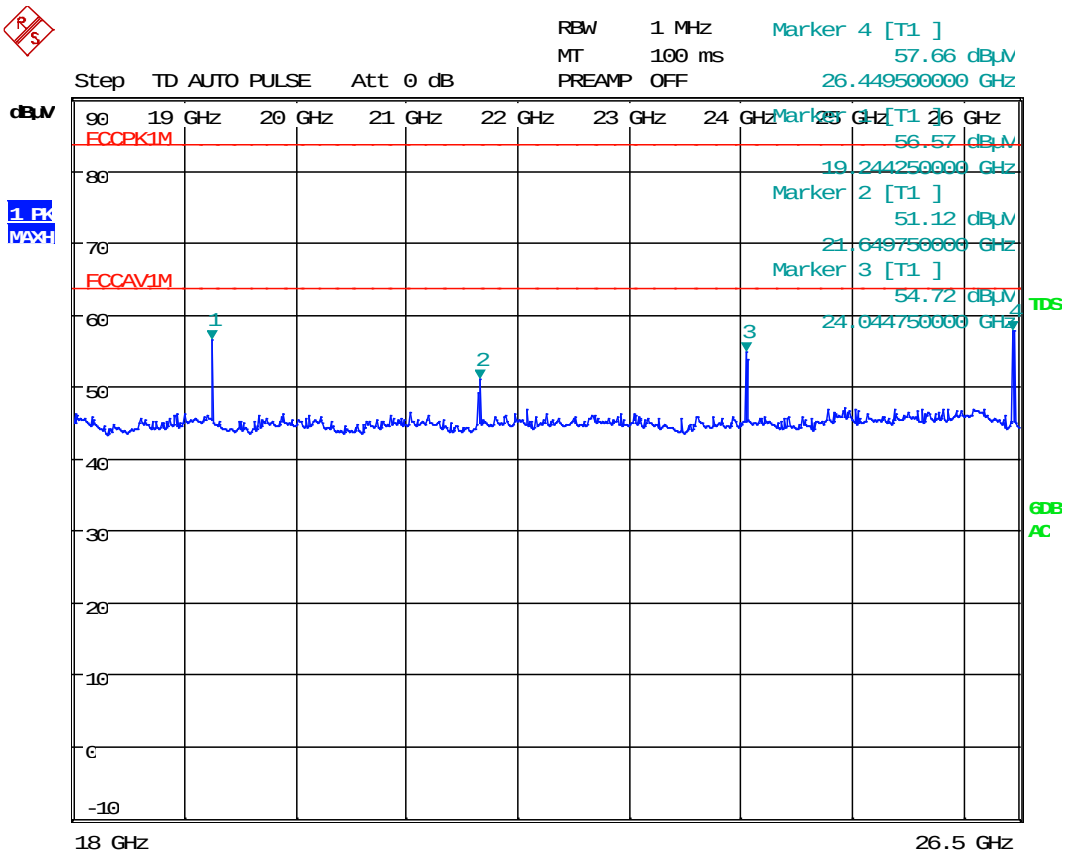
Date: 7.SEP.2016 17:21:37

1GHz-18GHz Horizontal: Channel 26



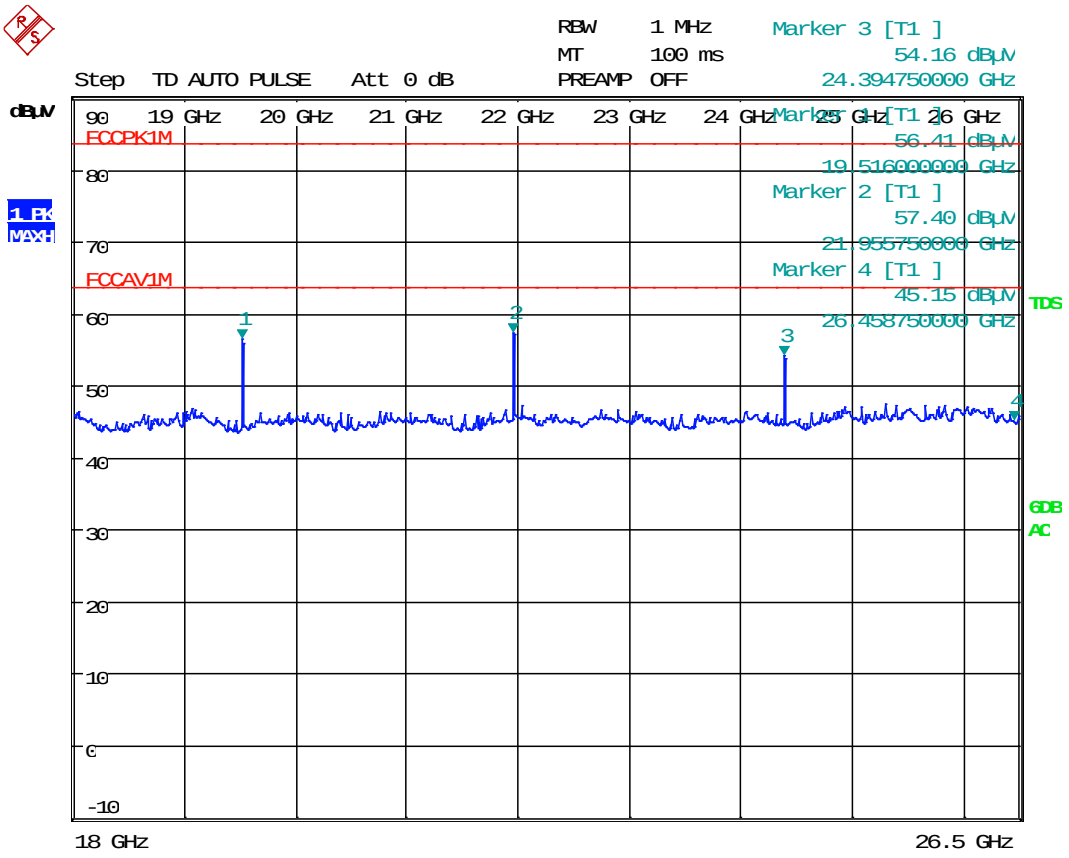
Date: 7.SEP.2016 17:57:36

18GHz-26.5GHz Horizontal: Channel 11 (1 Meter)



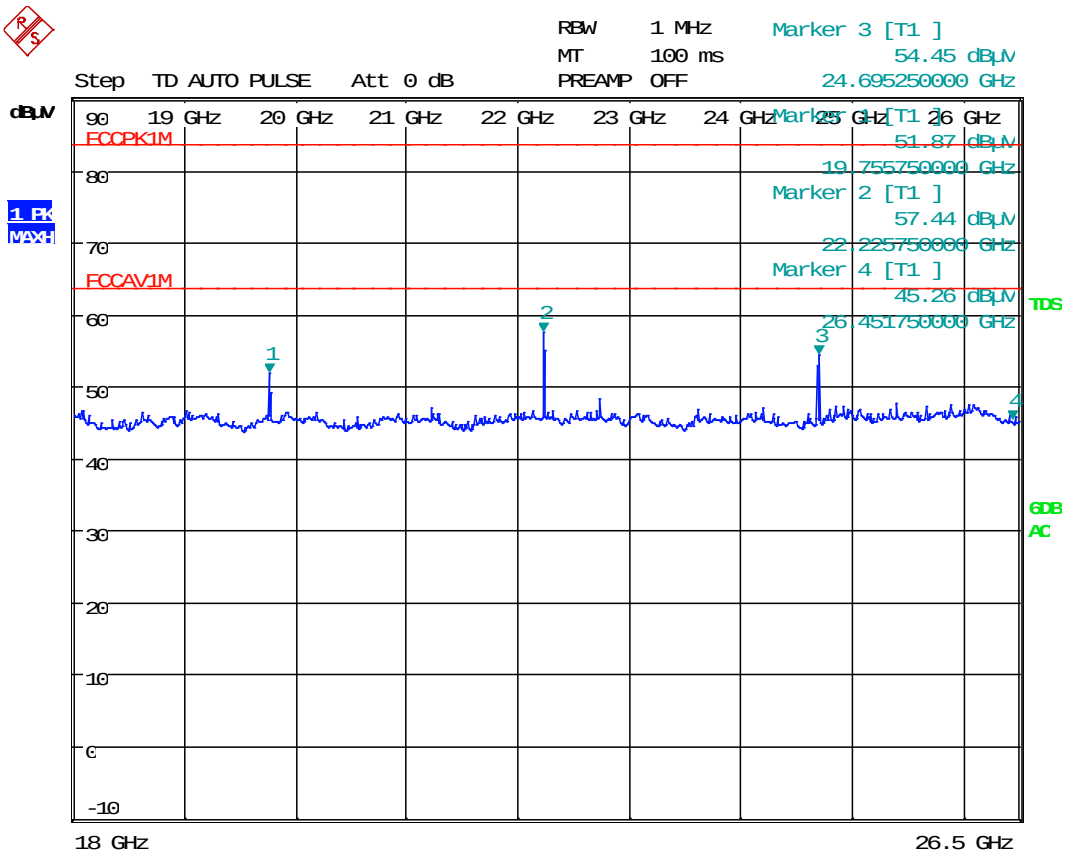
Date: 12.SEP.2016 11:35:07

18GHz-26.5GHz Horizontal: Channel 18 (1 Meter)



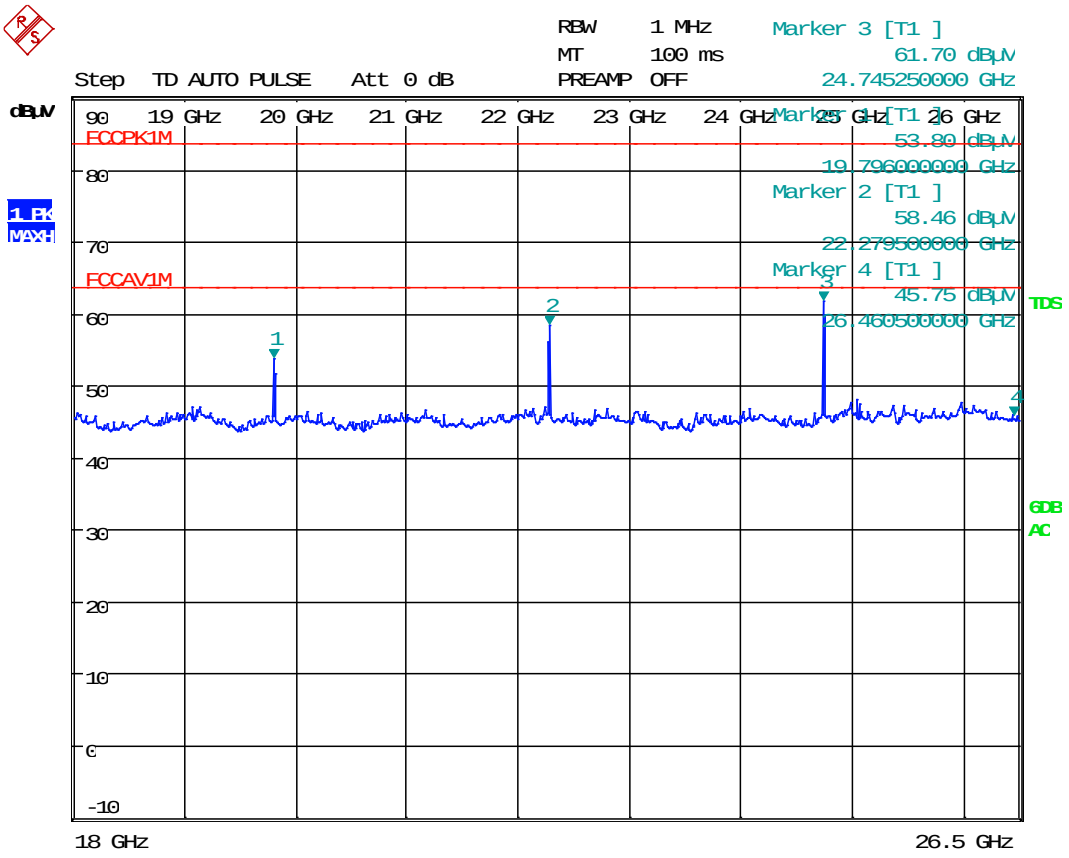
Date: 12.SEP.2016 11:50:30

18GHz-26.5GHz Horizontal: Channel 24 (1 Meter)



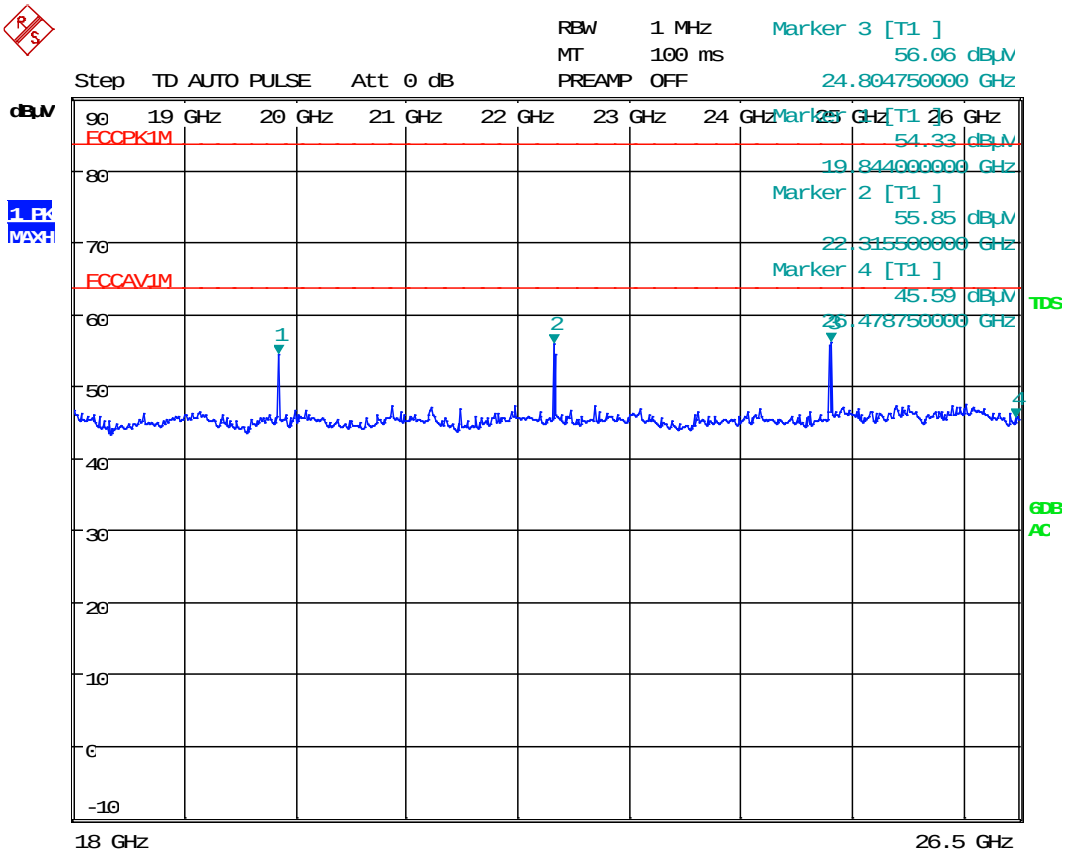
Date: 12.SEP.2016 11:57:55

18GHz-26.5GHz Horizontal: Channel 25 (1 Meter)



Date: 12.SEP.2016 12:04:51

18GHz-26.5GHz Horizontal: Channel 26 (1 Meter)



Date: 12.SEP.2016 12:18:24

Radiated Spurious Emissions Data (1GHz – 25GHz)

Ch #	Type	Freq (MHz)	Power Level Setting	Antenna Orient [1]	Antenna Dist (m)	Antenna Height (cm)	Table Azimuth Angle (Deg)	Meas Level (dBuV/m) PK	Meas Level (dBuV/m) AV	DCCF (dB)[2]	Corr Level (dBuV/m) PK	Corr Level (dBuV/m) AV	FCC Limit (dBuV/m) PK	FCC Limit (dBuV/m) AV	FCC Margin (dB) PK	FCC Margin (dB) AV
11	lbe	2390	8	h	3	198	41	60.2	54.2	-11.7	60.2	42.5	74	54	13.8	11.5
	f	2405	8	h	3	198	41	104.4	98.7				n/a	n/a		
	2f	4810	8	h	3	198	41	68.1	57.4	-11.7	68.1	45.7	74	54	6.0	8.3
	3f	7215	8	h	3	198	41	69.6	59.3	-11.7	69.6	47.7	74	54	4.4	6.3
	4f	9620	8	h	3	198	41	70.5	60.8	-11.7	70.5	49.1	74	54	3.5	4.9
18	f	2440	8	h	3	201	36	105.8	100.1				n/a	n/a		
	2f	4880	8	h	3	201	36	67.1	57.6	-11.7	67.1	46.0	74	54	6.9	8.0
	3f	7320	8	h	3	201	36	69.2	59.2	-11.7	69.2	47.6	74	54	4.8	6.4
	4f	9760	8	h	3	201	36	70.68	61.17	-11.7	70.7	49.5	74	54	3.3	4.5
24	f	2470	8	h	3	238	360	106.7	101.0				n/a	n/a		
	ube	2483	8	h	3	238	360	61.1	55.2	-11.7	61.1	43.6	74	54	13.0	10.4
25	f	2475	8	h	3	239	4	107.3	101.6				n/a	n/a		
	ube	2483	8	h	3	239	4	64.7	58.3	-11.7	64.7	46.7	74	54	9.3	7.3
	2f	4950	8	h	3	239	4	67.8	57.0	-11.7	67.8	45.4	74	54	6.2	8.6
	3f	7425	8	h	3	239	4	69.4	59.7	-11.7	69.4	48.0	74	54	4.7	6.0
	4f	9900	8	h	3	239	4	70.3	61.0	-11.7	70.3	49.4	74	54	3.7	4.6
26	f	2480	8	h	3	238	5	107.0	101.3				n/a	n/a		
	ube	2483	253	h	3	238	5	68.5	62.7	-11.7	68.5	51.0	74	54	5.5	3.0
	2f	4960	8	h	3	238	5	67.1	57.2	-11.7	67.1	45.5	74	54	6.9	8.5
	3f	7440	8	h	3	238	5	69.0	59.5	-11.7	69.0	47.8	74	54	5.1	6.2
	4f	9920	8	h	3	238	5	70.3	60.7	-11.7	70.3	49.0	74	54	3.7	5.0

[1] receiver antenna h (horizontal) orientation produced largest levels

[2] Measured DCCF(dB) = -11.7

Sample Calculation of the Electric Field Magnitude

The magnitude of the Electric field, ***E*** is calculated in *dBμV/m* in terms of the measured antenna output voltage and three transducer factors as follows:

$$E\ (dB\mu V/m) = AOV(dB\mu V) + AF(dB/m) + CL(dB) - AG(dB)$$

where,

AOV*(dBμV)* = Antenna Output Voltage in dB(μV),

AF*(dB/m)* = Antenna Factor in dB(1/m),

CL*(dB)* = Cable Loss in dB,

AG*(dB)* = Amplifier Gain in dB

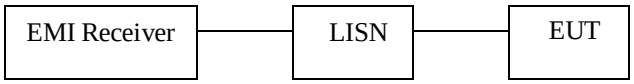
The three transducer factors ***AF***, ***CL*** and ***AG*** are stored in the EMI Receiver, as functions of frequency, over corresponding frequency ranges.

3.8 Transmitter AC Power line Conducted Emissions

Performance Criterion: AC power line conducted emissions shall not exceed the limits specified in FCC § 15.207 and Table 4 of IC RSS-Gen.

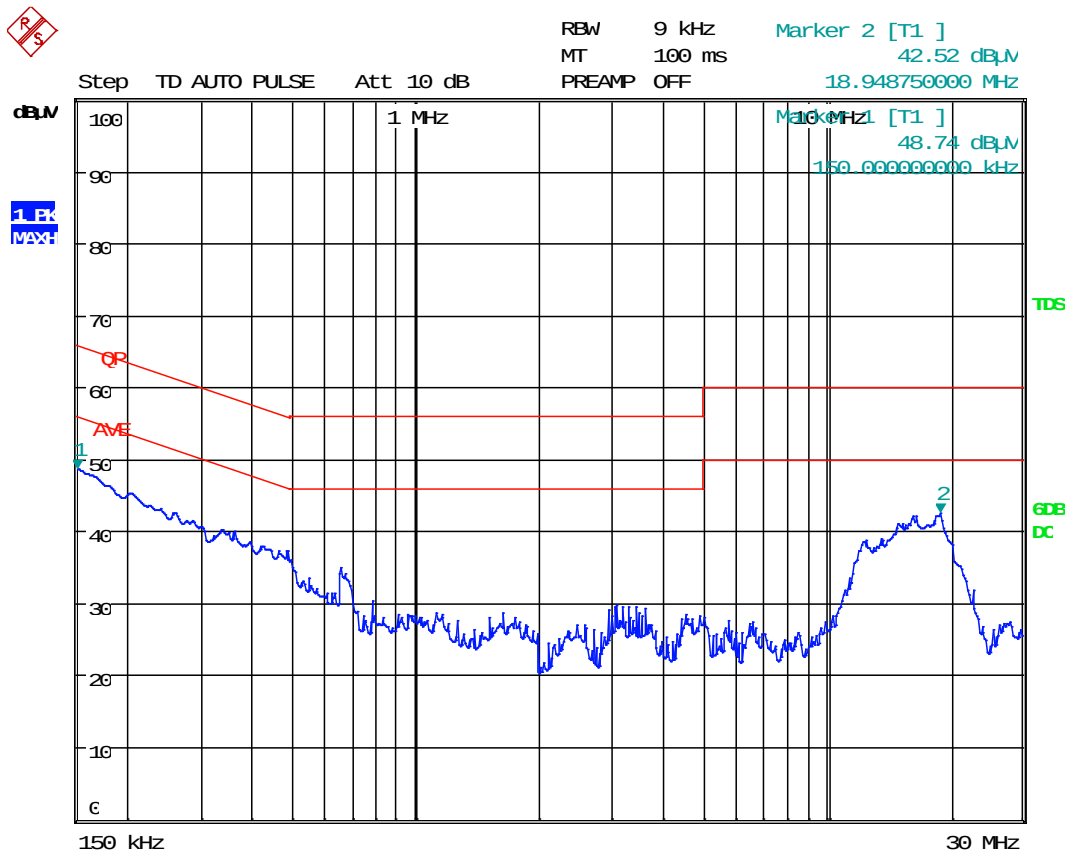
Test Details: AC power line conducted emissions were performed from 150 kHz to 30 MHz and measured with a resolution bandwidth of 9 kHz. EUT was set in the receiving mode. Refers to the following screen captures (using a peak detector) and block diagram

Block Diagram:



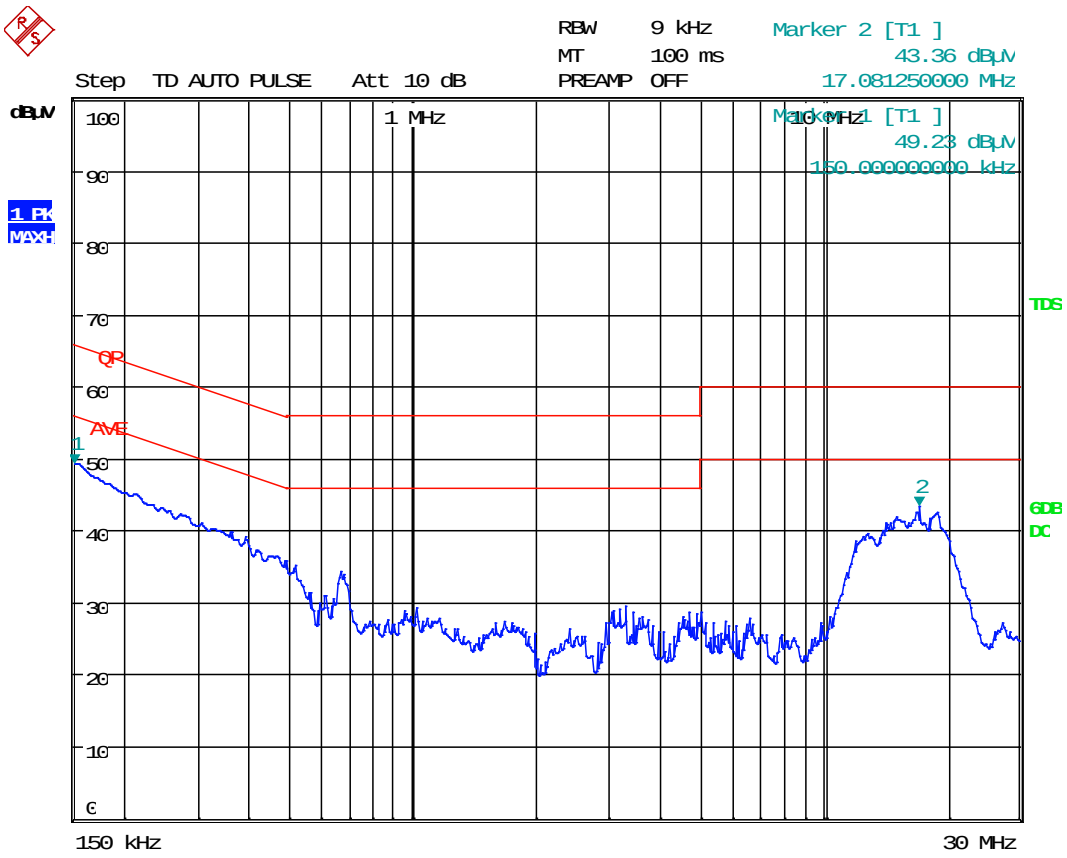
Note: AC side of AC-DC (support power supply) conducted emissions were measured.

Line 1:



Date: 31.AUG.2016 17:08:57

Line 2:

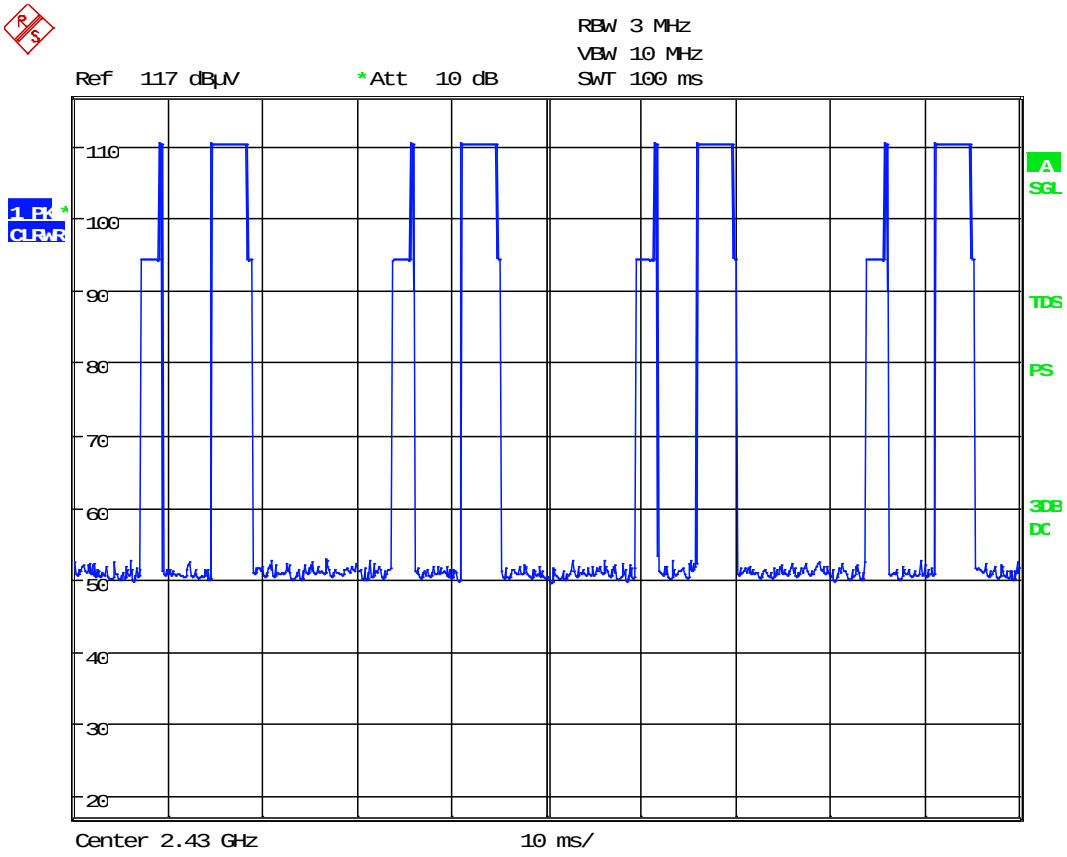


Date: 31.AUG.2016 17:18:06

AC Line Conducted Emissions Data

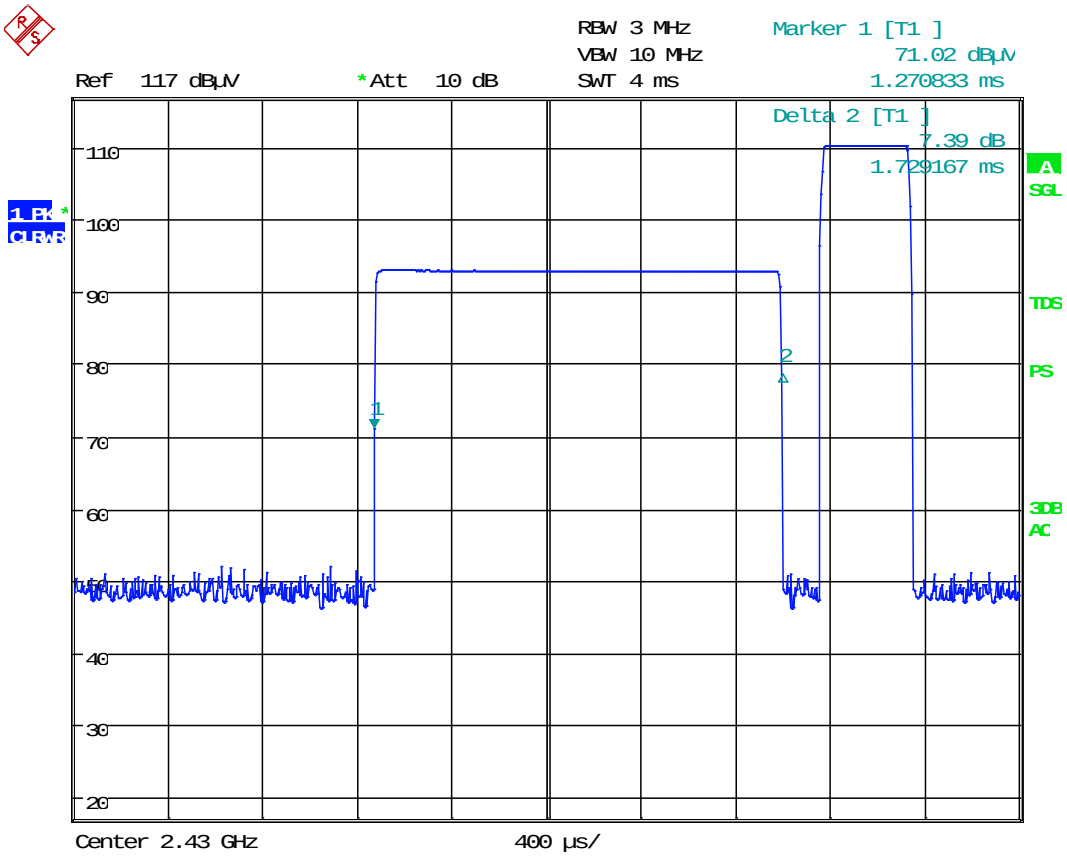
			FCC15 Class B			
Frequency (MHz)	**Measured Level (dBuV)**		**Limits (dBuV)**		**Margins (dB)**	
	QP	**AV**	**QP**	**AV**	**QP**	**AV**
120V/L1						
0.15	43	24.3	66.0	56.0	23.0	31.7
18.94875	37.4	30.4	60.0	50.0	22.6	19.6
120V/L2						
0.15	43	25.2	66.0	56.0	23.0	30.8
17.08125	35.2	28.7	60.0	50.0	24.8	21.3

3.9 Duty Cycle Correction Factor (DCCF) Measurement



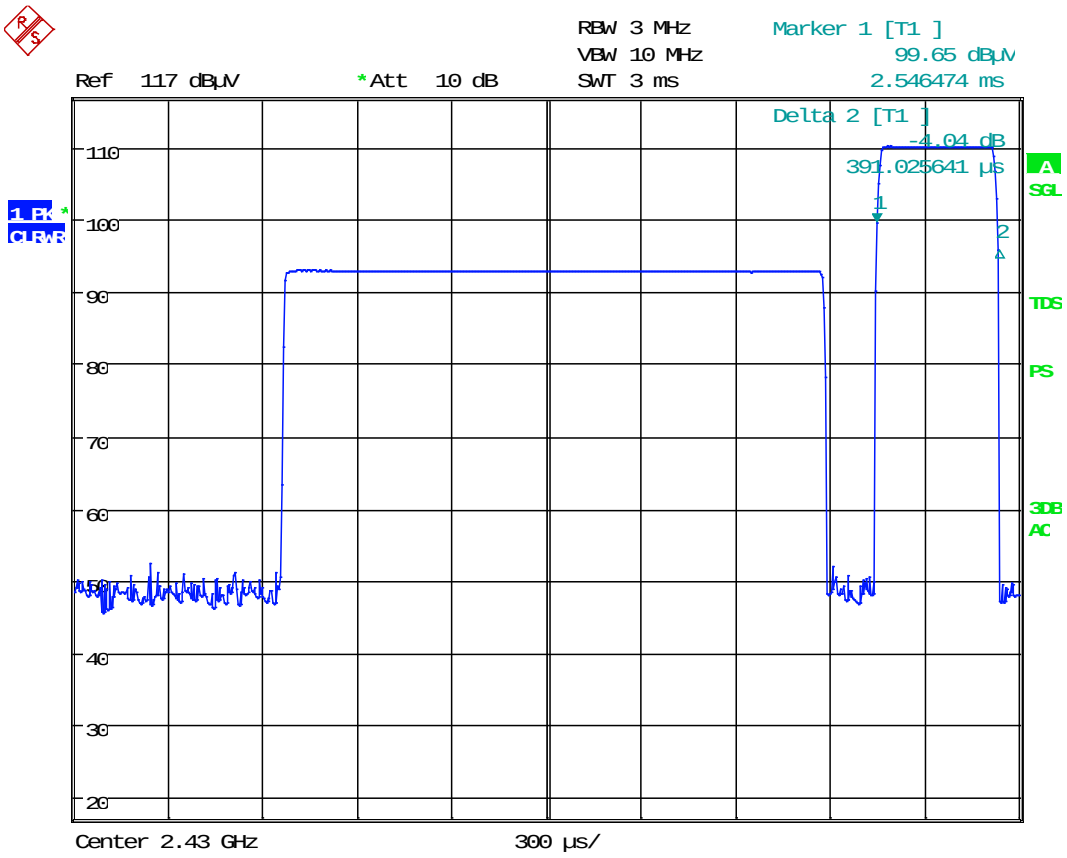
Date: 6.SEP.2016 11:30:40

Pulse1-Sample1



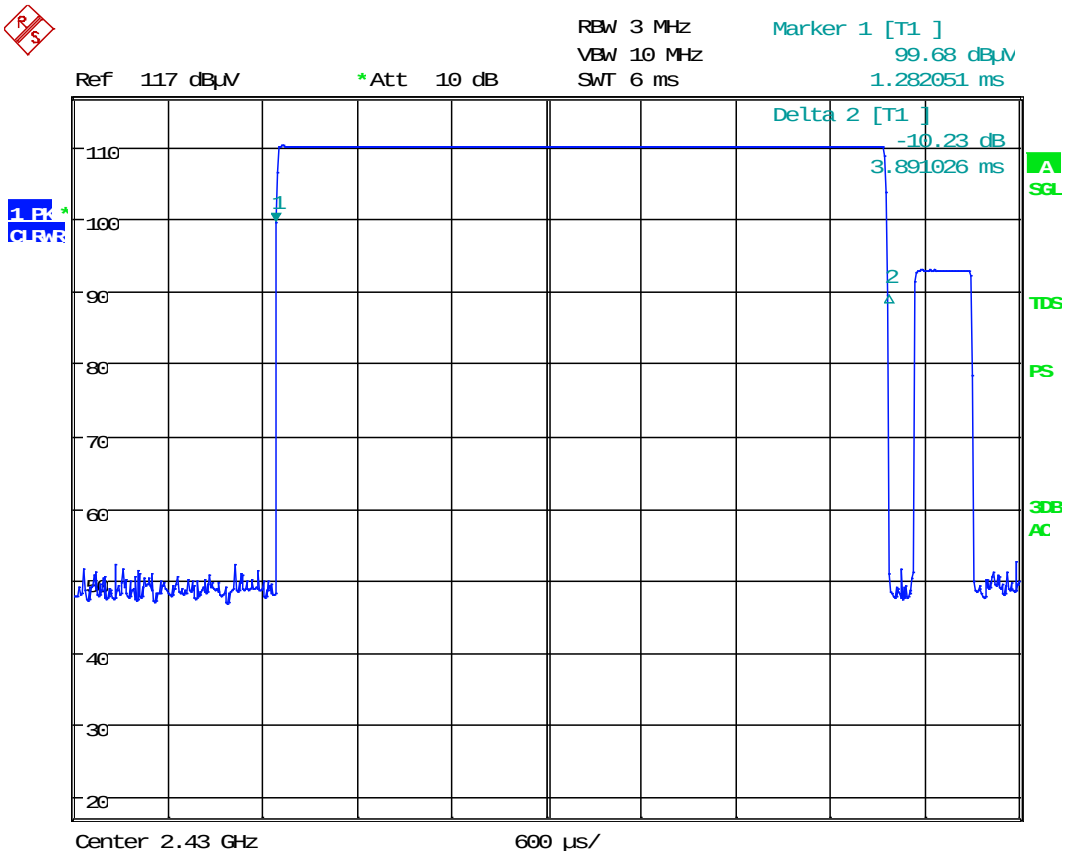
Date: 6.SEP.2016 15:06:47

Pulse2-Sample1



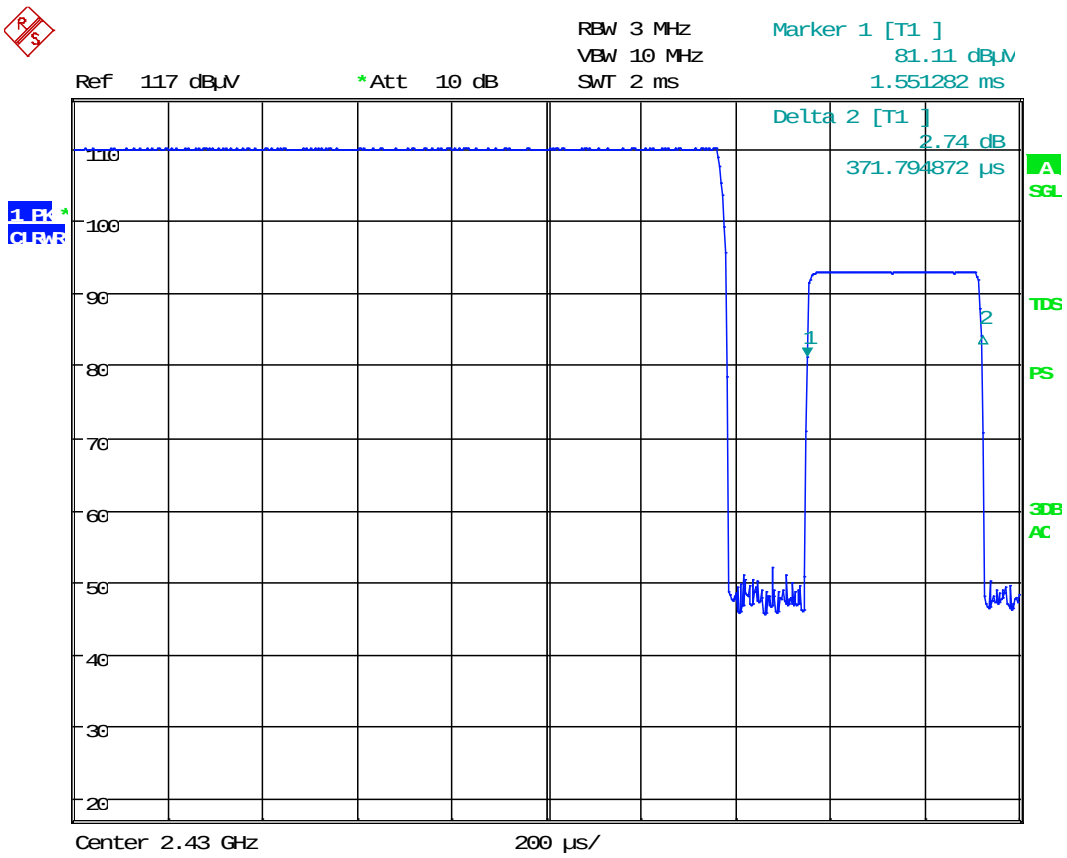
Date: 6.SEP.2016 15:12:21

Pulse3-Sample1



Date: 6.SEP.2016 15:30:21

Pulse 4-Sample1



Date: 6.SEP.2016 15:36:14

Calculation of the Duty Cycle Correction Factor (DCCF)

The DCCF is defined by the following relationship:

$$DCCF(dB) = 20\ log_{10}(\{Duty\ Cycle\ over\ a\ 100\ ms\ interval)$$

four different pulses repeated four times over a 100 ms interval, as follows:

time in milliseconds

	p1	p2	p3	p4
s1	1.729167	0.391025641	3.891026	0.371795
s2	1.722756	0.391025641	3.891026	0.375
s3	1.729167	0.395833333	3.88141	0.371795
s4	1.722756	0.391025641	3.88141	0.371795
Sum of Pulse Lengths (ms)	6.903846	1.568910256	15.54487	1.490385

Sum of all pulses over 100 ms 25.50801287

DutCycle 0.255080129

DCCF(dB)= -11.87