Report On

FCC Testing of the
Sharp Quad-band LTE(B1 /B3/ B19/ B21), and Tri-band WCDMA(FDD I/ VI /XIX) Dual mode hand held Mini Phablet with Bluetooth, ANT+, W-LAN, NFC and GPS
In accordance with FCC CFR 47 Part 15C (Bluetooth)

COMMERCIAL-IN-CONFIDENCE

FCC ID: APYHRO00216

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REPORT ON

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Document 75928438 Report 01 Issue 1

January 2015

PREPARED FOR

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PREPARED BY

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Matthew Russell
Authorised Signatory

DATED 13 January 2015

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47 Part 15C. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);

J Tuckwell J Hurley T Guy

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Product Service

SECTION 1

REPORT SUMMARY

FCC Testing of the
Sharp Quad-band LTE(B1 /B3/ B19/ B21), and Tri-band WCDMA(FDD I/ VI /XIX) Dual mode hand held Mini Phablet with Bluetooth, ANT+, W-LAN, NFC and GPS
In accordance with FCC CFR 47 Part 15C (Bluetooth)

1.1 INTRODUCTION

The information contained in this report is intended to show the verification of FCC Testing of the Sharp Quad-band LTE(B1 /B3/ B19/ B21), and Tri-band WCDMA(FDD I/ VI /XIX) Dual mode hand held Mini Phablet with Bluetooth, ANT+, W-LAN, NFC and GPS to the requirements of FCC CFR 47 Part 15C.

Objective	To perform FCC Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Sharp Corporation
Serial Number(s)	IMEI 004401115303352 IMEI 004401115303444 IMEI 004401115303378
Number of Samples Tested	3
Test Specification/Issue/Date	FCC CFR 47 Part 15C (2013)
Incoming Release Date	Application Form 19 November 2014
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	10377 02 December 2014
Start of Test	24 November 2014
Finish of Test	12 December 2014
Name of Engineer(s)	J Tuckwell J Hurley T Guy
Related Document(s)	ANSI C63.10: 2009

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1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC CFR 47 Part 15C is shown below.

Section	Spec Clause	Test Description	Result	Comments/Base Standard
Bluetooth				
2.1	15.207	AC Line Conducted Emissions	Pass	
2.2	15.247 (a)(1)	Frequency Hopping Systems - 20dB Bandwidth and Channel Separation	Pass	
2.3	15.247 (a)(1)(iii)	Frequency Hopping Systems - Channel Dwell Time and Number of Hopping Channels	Pass	
2.4	15.247 (b)(3)	Maximum Peak Conducted Output Power	Pass	
2.5	15.247 (b)(4)	EIRP Peak Power	Pass	
2.6	15.247 (d)	Spurious and Band Edge Emissions	Pass	

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1.3 APPLICATION FORM

EQUIPMENT DESCRIPTION	
Model Name/Number	See APYHRO00216 Model Description form
Part Number	CA283
FCC ID (if applicable)	APYHRO00216
Industry Canada ID (if applicable)	N/A
Technical Description (Please provide a brief description of the intended use of the equipment)	Quad-band LTE(B1/B3/B19/B21), Tri-band WCDMA(FDD-I/VI/XIX), Dual mode Mini Tablet with Bluetooth, ANT+, WLAN, NFC and GPS

Types of Modulations used by the Equipment	
☒	FHSS
☒	Other forms of modulation
In case of FHSS Modulation	
In case of non-Adaptive Frequency Hopping equipment:	
	Number of Hopping Frequencies: N/A
In case of Adaptive Frequency Hopping Equipment:	
	Maximum number of Hopping Frequencies: Bluetooth(BR/EDR);79/ LE; 40
	Minimum number of Hopping Frequencies: 20
Dwell Time: 3.75ms	
Minimum Channel Occupation Time: 1.25ms (5.5ms maximum)	
Adaptive / non-adaptive equipment:	
☐	non-adaptive Equipment
☒	adaptive Equipment without the possibility to switch to a non-adaptive mode
☐	adaptive Equipment which can also operate in a non-adaptive mode
In case of adaptive equipment:	
The Channel Occupancy Time implemented by the equipment: 13 ms	
☒	The equipment has implemented an LBT based DAA mechanism
In case of equipment using modulation different from FHSS:	
☐	The equipment is Frame Based equipment
☐	The equipment is Load Based equipment
☒	The equipment can switch dynamically between Frame Based and Load Based equipment
The CCA time implemented by the equipment: 34 µs	
The value q as referred to in clause 4.3.2.5.2.2.2 is: 32	
☐	The equipment has implemented an non-LBT based DAA mechanism
☐	The equipment can operate in more than one adaptive mode

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In case of non-adaptive Equipment:		
The maximum RF Output Power (e.i.r.p.): Bluetooth;7dBm/ WLAN;14.0 dBm		
The maximum (corresponding) Duty Cycle: %		
Equipment with dynamic behaviour, that behaviour is described here. (e.g. the different combinations of duty cycle and corresponding power levels to be declared):		
The worst case operational mode for each of the following tests:		
RF Output Power: Max.7dBm/ Nominal 4dBm(Bluetooth Power class-1), Max. 14dBm(IEEE802.11b)		
Power Spectral Density:		
Duty cycle, Tx-Sequence, Tx-gap:		
Dwell time, Minimum Frequency Occupation & Hopping Sequence (only for FHSS equipment): To be determined by test lab.		
Hopping Frequency Separation (only for FHSS equipment): To be determined by test lab.		
Medium Utilisation: To be determined by test lab.		
Adaptivity & Receiver Blocking: To be determined by test lab.		
Occupied Channel Bandwidth: To be determined by test lab.		
Transmitter unwanted emissions in the OOB domain: To be determined by test lab.		
Transmitter unwanted emissions in the spurious domain: To be determined by test lab.		
Receiver spurious emissions: To be determined by test lab.		
The different transmit operating modes (tick all that apply):		
☒	Operating mode 1: Single Antenna Equipment	
	☒	Equipment with only 1 antenna
	☐	Equipment with 2 diversity antennas but only 1 antenna active at any moment in time
	☐	Smart Antenna Systems with 2 or more antennas, but operating in a (legacy) mode where only 1 antenna is used. (e.g. IEEE 802.11™ [i.3] legacy mode in smart antenna systems)
☐	Operating mode 2: Smart Antenna Systems - Multiple Antennas without beam forming	
	☐	Single spatial stream / Standard throughput / (e.g. IEEE 802.11™ [i.3] legacy mode)
	☐	High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1
	☐	High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2
NOTE: Add more lines if more channel bandwidths are supported.		
☐	Operating mode 3: Smart Antenna Systems - Multiple Antennas with beam forming	
	☐	Single spatial stream / Standard throughput (e.g. IEEE 802.11™ [i.3] legacy mode)
	☐	High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1
	☐	High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2
NOTE: Add more lines if more channel bandwidths are supported.		
In case of Smart Antenna Systems:		
The number of Receive chains:		
The number of Transmit chains:		
☐	symmetrical power distribution	
☐	asymmetrical power distribution	
In case of beam forming, the maximum beam forming gain:		
NOTE: Beam forming gain does not include the basic gain of a single antenna.		

Product Service

Operating Frequency Range(s) of the equipment:	
Operating Frequency Range 1: 2402 MHz to 2480 MHz	Bluetooth (e.g Bluetooth for EU)
Operating Frequency Range 2: 2412 MHz to 2472 MHz	WLAN dor EU (e.g WLAN for EU)
Operating Frequency Range 3: MHz to MHz	(e.g Bluetooth for FCC and/or Industry Canada)
Operating Frequency Range 4: MHz to MHz	(e.g WLAN for FCC and/or Industry Canada)
NOTE: Add more lines if more Frequency Ranges are supported.	

Occupied Channel Bandwidth(s):
Occupied Channel Bandwidth1: 1 MHz to 2 (LE) MHz
Occupied Channel Bandwidth2: 20 (802.11 b/g) MHz to 40 (802.11n) MHz
NOTE: Add more lines if more channel bandwidths are supported.

Type of Equipment (stand-alone, combined, plug-in radio device, etc.):	
☒	Stand-alone
☐	Combined Equipment (Equipment where the radio part is fully integrated within another type of equipment)
☐	Plug-in radio device (Equipment intended for a variety of host systems)
☐	Other

The extreme operating conditions that apply to the equipment:		
Operating temperature range: -10 °C to 55 °C		
Operating voltage range: 3.7 V to 4.0 V	☐ AC	☒ DC
	Details provided are for the:	
☒	stand-alone equipment	
☐	combined (or host) equipment	
☐	test jig	

Product Service

The intended combination(s) of the radio equipment power settings and one or more antenna assemblies and their corresponding e.i.r.p levels:			
Antenna Type:			
☒ Integral Antenna			
Antenna Gain: 0 dBi			
If applicable, additional beamforming gain (excluding basic antenna gain): dB			
☒ Temporary RF connector provided			
☐ No temporary RF connector provided			
☐ Dedicated Antennas (equipment with antenna connector)			
☐ Single power level with corresponding antenna(s)			
☐ Multiple power settings and corresponding antenna(s)			
Number of different Power Levels:			
Power Level 1: dBm			
Power Level 2: dBm			
Power Level 3: dBm			
Power Level 4: dBm			
NOTE 1: Add more lines in case the equipment has more power levels.			
NOTE 2: These power levels are conducted power levels (at antenna connector).			
For each of the Power Levels, provide the intended antenna assemblies, their corresponding gains (G) and the resulting e.i.r.p. levels also taking into account the beamforming gain (Y) if applicable			
Power Level 1: dBm			
Number of antenna assemblies provided for this power level:			
Assembly #	**Gain (dBi)**	**e.i.r.p (dBm)**	**Part number or model number**
1			
2			
3			
4			
NOTE: Add more rows in case more antenna assemblies are supported for this power level.			
Power Level 2: dBm			
Number of antenna assemblies provided for this power level:			
Assembly #	**Gain (dBi)**	**e.i.r.p (dBm)**	**Part number or model number**
1			
2			
3			
4			
NOTE: Add more rows in case more antenna assemblies are supported for this power level.			
Power Level 3: dBm			
Number of antenna assemblies provided for this power level:			
Assembly #	**Gain (dBi)**	**e.i.r.p (dBm)**	**Part number or model number**
1			
2			
3			
4			
NOTE: Add more rows in case more antenna assemblies are supported for this power level.			

Product Service

The nominal voltages of the stand-alone radio equipment or the nominal voltages of the combined (host) equipment or test jig in case of plug-in devices:	
Details provided are for the: ☒ stand-alone equipment	
☐ combined (or host) equipment	
☐ test jig	
Supply Voltage ☐ AC mains State AC voltage	
☒ State DC voltage 4.0	
In case of DC, indicate the type of power source	
☐ Internal Power Supply	
☐ External Power Supply or AC/DC adapter	
☒ Battery	
☐ Other:	
Describe the test modes available which can facilitate testing:	
The equipment type (e.g. Bluetooth®, IEEE 802.11™ [i.3], proprietary, etc.):	
Bluetooth Ver.4 and , IEEE 802.11b/g/n	
Combination for testing (see clause 5.1.3.3 of EN 300 328 V1.8.1)	
From all combinations of conducted power settings and intended antenna assembly(ies) specified in clause 3.1 m), specify the combination resulting in the highest e.i.r.p. for the radio equipment. Unless otherwise specified in EN 300 328, this power setting is to be used for testing against the requirements of EN 300 328. In case there is more than one such conducted power setting resulting in the same (highest) e.i.r.p. level, the highest power setting is to be used for testing. See also EN 300 328, clause 5.1.3.3.	
Highest overall e.i.r.p. value: dBm	
Corresponding Antenna assembly gain: dBi	Antenna Assembly #:
Corresponding conducted power setting: dBm	Listed as Power Setting #:
(also the power level to be used for testing)	
Additional information provided by the applicant	
Modulation	
ITU Class(es) of emission:	
Can the transmitter operate unmodulated? ☐ Yes ☐ No	
Duty Cycle	
The transmitter is intended for:	
☐ Continuous duty	
☐ Intermittent duty	
☒ Continuous operation possible for testing purposes	
About the UUT	
☐ The equipment submitted are representative production models	
☐ If not, the equipment submitted are pre-production models ?	
☒ If pre-production equipment are submitted, the final production equipment will be identical in all respects with the equipment tested	
☐ If not, supply full details	
☐ The equipment submitted is CE marked	
☐ In addition to the CE mark, the Class-II identifier (Alert Sign) is affixed.	

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	Additional items and/or supporting equipment provided
☐	Spare batteries (e.g. for portable equipment)
☒	Battery charging device
☐	External Power Supply or AC/DC adapter
☐	Test Jig or interface box
☐	RF test fixture (for equipment with integrated antennas)
☐	Host System
	Manufacturer
	Model
	Model Name
☐	Combined equipment
	Manufacturer
	Model
	Model Name
☐	User Manual
☐	Technical documentation (Handbook and circuit diagrams)

I hereby declare that I am entitled to sign on behalf of the applicant and that the information supplied is correct and complete.

Signature: N. Arai Name: Nobumasa Arai

Position held: Manager Date: 19th November 2014

Product Service

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Sharp Quad-band LTE(B1 /B3/ B19/ B21), and Tri-band WCDMA(FDD I/ VI /XIX) Dual mode hand held Mini Phablet with Bluetooth, ANT+, W-LAN, NFC and GPS. A full technical description can be found in the manufacturer's documentation.

1.5 TEST CONDITIONS

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Tests were applied with the EUT situated in a shielded enclosure.

The EUT was powered from a 4.0 V DC supply.

FCC Measurement Facility Registration Number
90987 Octagon House, Fareham Test Laboratory

1.6 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standard or test plan were made during testing.

1.7 MODIFICATION RECORD

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Serial Number: IMEI 004401115303352			
0	As supplied by manufacturer.	N/A	N/A
1	Adjusted display driver parameters in firmware	M Russell	11/12/2014
Serial Number: IMEI 004401115303444			
0	As supplied by manufacturer.	N/A	N/A
Serial Number: IMEI 004401115303378			
0	As supplied by manufacturer.	N/A	N/A

The table above details modifications made to the EUT during the test programme. The modifications incorporated during each test are recorded on the appropriate test pages.

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SECTION 2

TEST DETAILS

FCC Testing of the
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In accordance with FCC CFR 47 Part 15C (Bluetooth)

2.1 AC LINE CONDUCTED EMISSIONS

2.1.1 Specification Reference

FCC CFR 47 Part 15C, Clause 15.207

2.1.2 Equipment Under Test and Modification State

S/N: IMEI 004401115303352 - Modification State 0

2.1.3 Date of Test

4 December 2014

2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.5 Test Procedure

A test environment and testing arrangement meeting the specification of ANSI C63.4 was used during all testing. The Equipment Under Test (EUT) was set upon a non-conducting platform at an elevation of 80 cm above a horizontal reference ground plane. A vertical reference ground plane was situated 40 cm from the EUT and bonded to the horizontal reference ground plane.

The EUT was powered by a Line Impedance Stabilization Network (LISN), whereby emissions measurements of the current-carrying conductors were made through this LISN. The LISN was bonded to the horizontal reference ground plane with a separation distance greater than 80 cm from the EUT. A mains supply cable of 1 m length was used to supply mains power to the EUT from the LISN.

A preliminary emissions scan was conducted for each current-carrying conductor of the EUT, using a peak detector over a frequency range of 150 kHz to 30 MHz. At least six of the greatest peak emissions, frequency positions were selected from each preliminary emissions scan for further evaluation as final measuring points.

Final measurement points were measured using quasi-peak and average detectors. All final measurements were assessed against the emission limits in Clause 15.207 of FCC CFR 47 FCC Part 15.

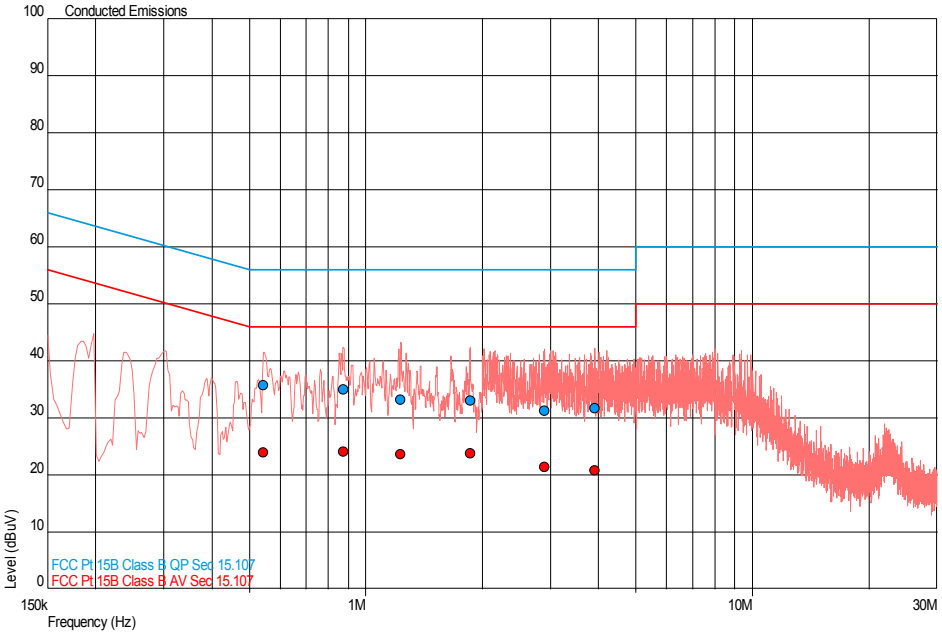
2.1.6 Environmental Conditions

Ambient Temperature	19.3°C
Relative Humidity	31.0%

Product Service

2.1.7 Test Results

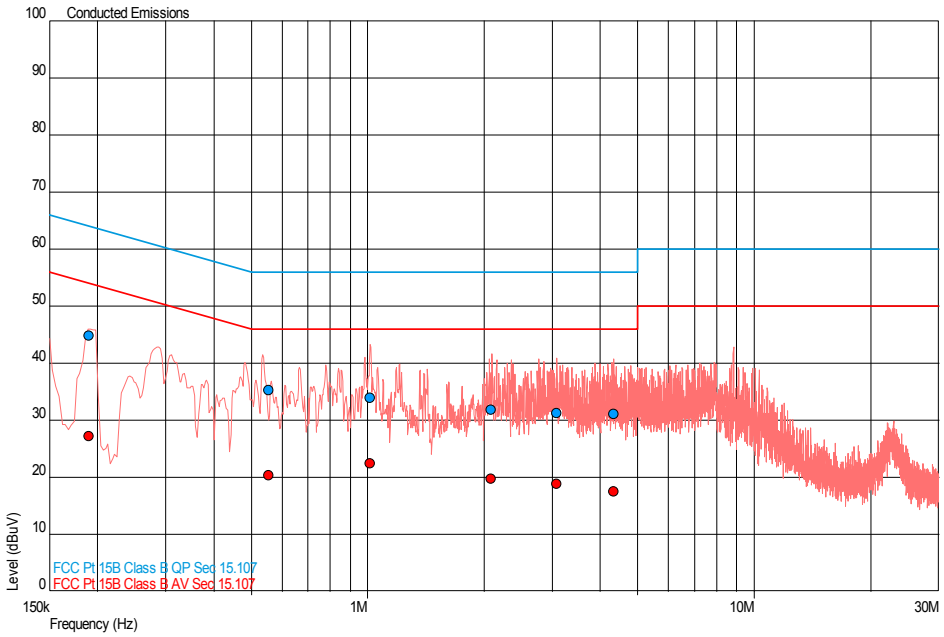
Live Line



Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dBµV)	AV Level (dBµV)	AV Limit (dBuV)	AV Margin (dBµV)
0.544	35.8	56.0	-20.2	23.9	46.0	-22.1
0.876	35.0	56.0	-21.0	24.1	46.0	-21.9
1.231	33.2	56.0	-22.8	23.7	46.0	-22.3
1.862	33.1	56.0	-22.9	23.9	46.0	-22.1
2.903	31.3	56.0	-24.7	21.4	46.0	-24.6
3.920	31.7	56.0	-24.3	20.8	46.0	-25.2

Product Service

Neutral Line



Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dBµV)	AV Level (dBµV)	AV Limit (dBuV)	AV Margin (dBµV)
0.190	44.8	64.1	-19.2	27.3	54.1	-26.8
0.553	35.4	56.0	-20.6	20.3	46.0	-25.7
1.016	34.0	56.0	-22.0	22.5	46.0	-23.5
2.089	31.9	56.0	-24.1	19.8	46.0	-26.2
3.083	31.3	56.0	-24.7	18.9	46.0	-27.1
4.333	31.1	56.0	-24.9	17.5	46.0	-28.5

2.2 FREQUENCY HOPPING SYSTEMS – 20 dB BANDWIDTH AND CHANNEL SEPARATION

2.2.1 Specification Reference

FCC CFR 47 Part 15C, Clause 15.247 (a)(1)

2.2.2 Equipment Under Test and Modification State

S/N: IMEI 004401115303444 - Modification State 0

2.2.3 Date of Test

24 November 2014

2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.5 Test Procedure

The test was applied in accordance with the test method requirements of ANSI C63.10 2009 section 7.7.

The EUT was transmitted at maximum power on bottom, middle and top channels for DH5, 2DH5 and 3DH5 packet types. The EUT was connected to a spectrum analyser via a cable and attenuator. The Analyser settings were adjusted to display the resultant trace on screen with an RBW of 30 kHz. The peak point of the trace was measured and the markers positioned to give the -20 dBc points of the displayed spectrum.

The EUT was then configured to transmit over all hopping frequencies with GFSK modulation. The trace was set to Max Hold to store several adjacent channels on screen. Using the marker delta function, the markers were positioned to show the separation between adjacent channels. For modulations other than GFSK, the EUT was configured to transmit on one static channel and the adjacent channel in turn. Separate traces were used for each channel to differentiate between the two signals.

2.2.6 Environmental Conditions

Ambient Temperature	20.7°C
Relative Humidity	31.5%

Product Service

2.2.7 Test Results

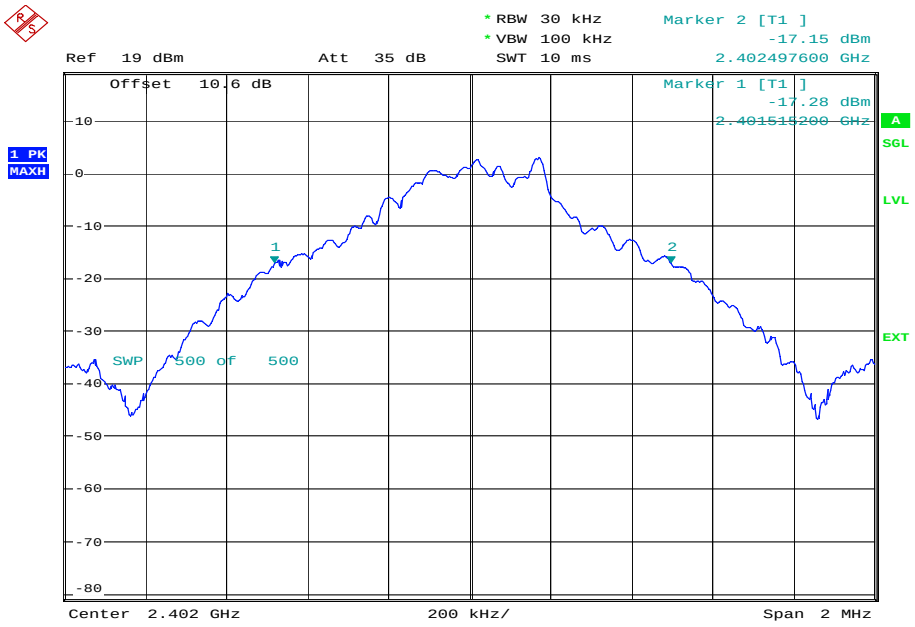
4.0 V DC Supply

20 dB Bandwidth

2402 MHz

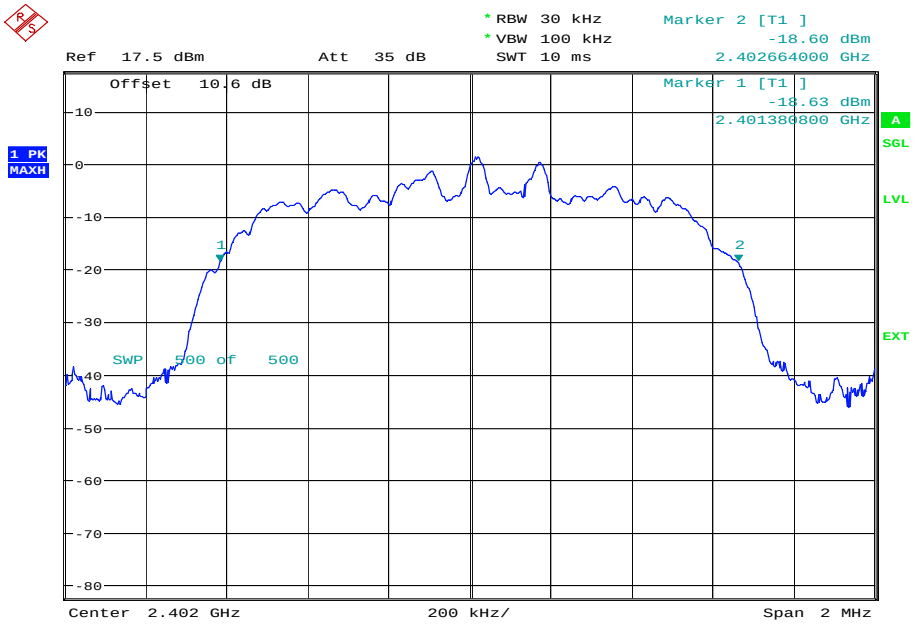
Modulation/Packet Type	20 dB Bandwidth (kHz)
GFSK/DH5	982.4
pi/4 DQPSK/2DH5	1283.2
8-DPSK/3DH5	1289.6

DH5



Product Service

2DH5



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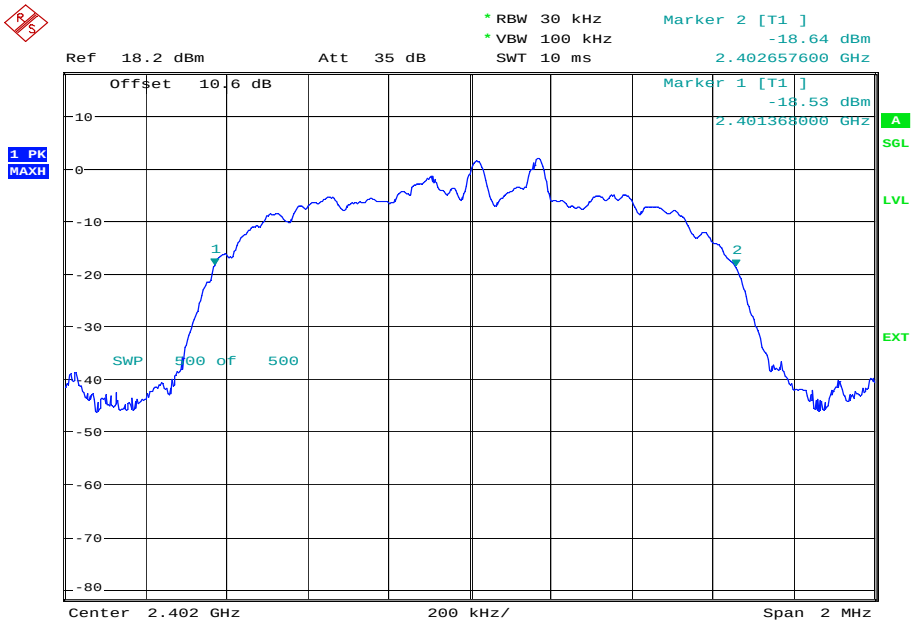
3DH5



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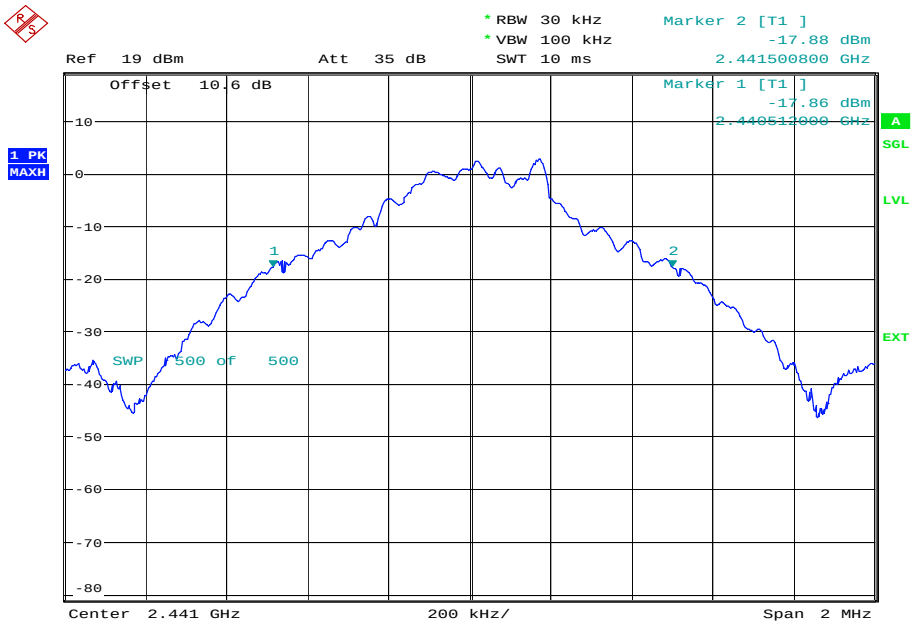
2441 MHz

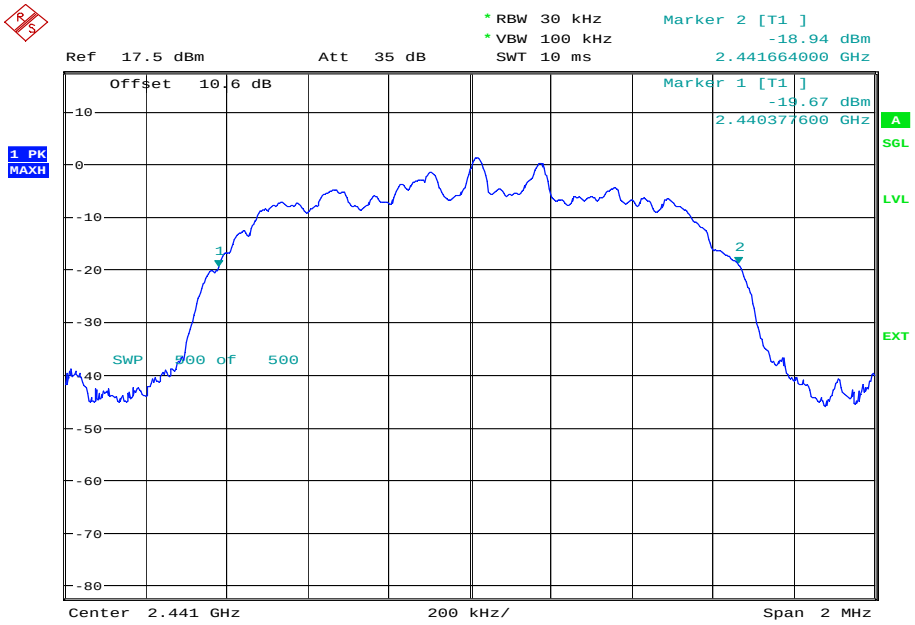
Modulation/Packet Type	20 dB Bandwidth (kHz)
GFSK/DH5	988.8
pi/4 DQPSK/2DH5	1286.4
8-DPSK/3DH5	1283.2

DH5



Product Service

2DH5



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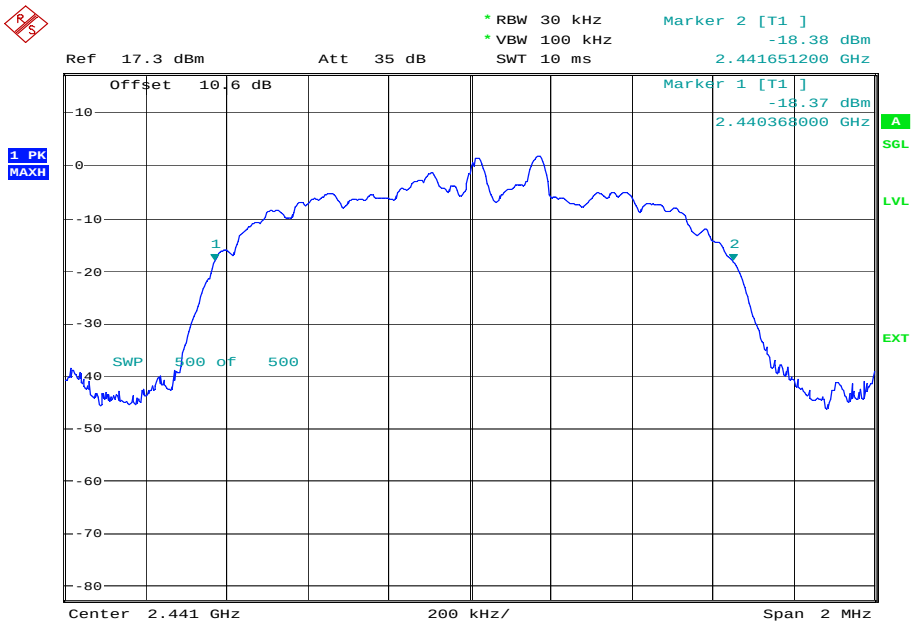

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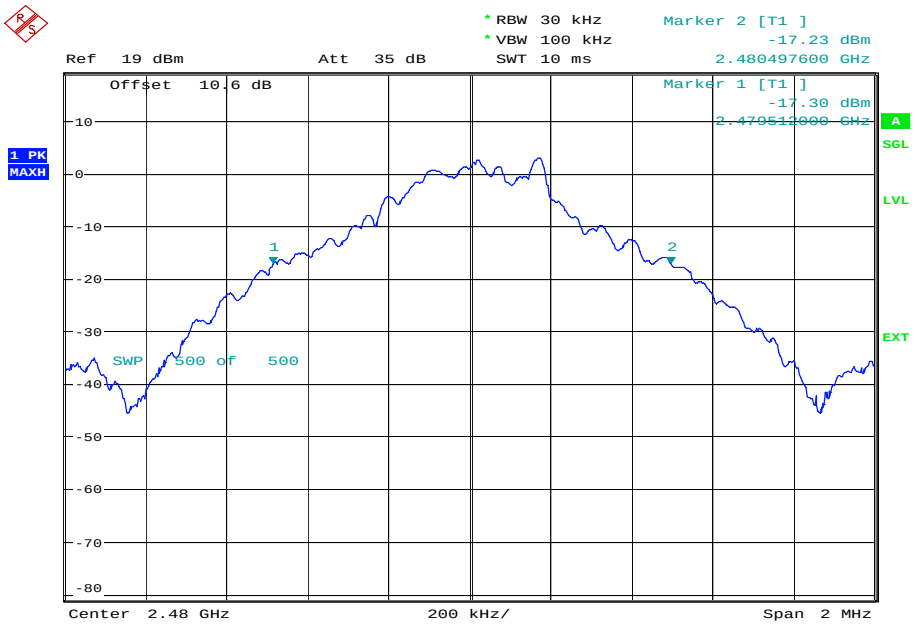
2480 MHz

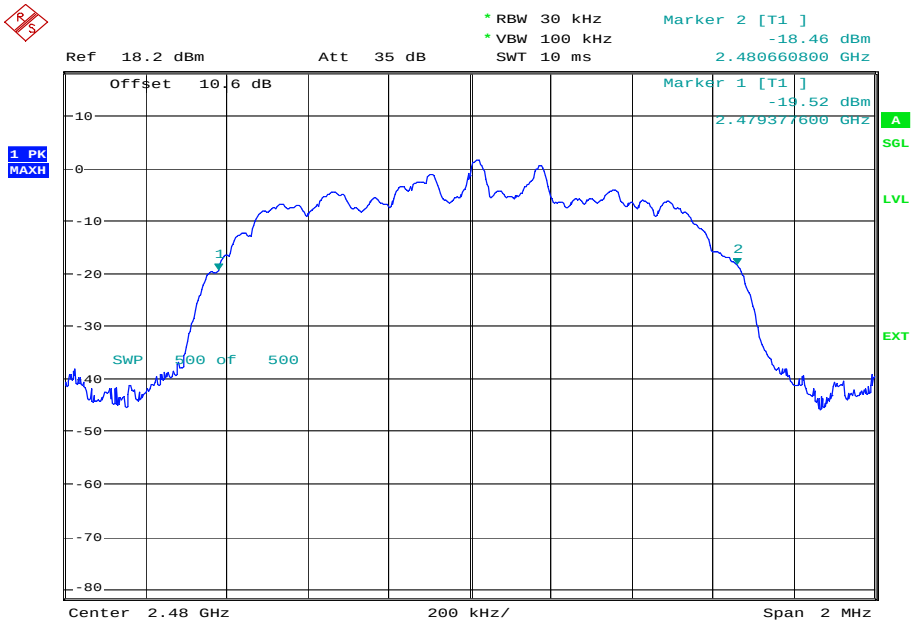
Modulation/Packet Type	20 dB Bandwidth (kHz)
GFSK/DH5	985.6
pi/4 DQPSK/2DH5	1283.2
8-DPSK/3DH5	1286.4

DH5



Product Service

2DH5



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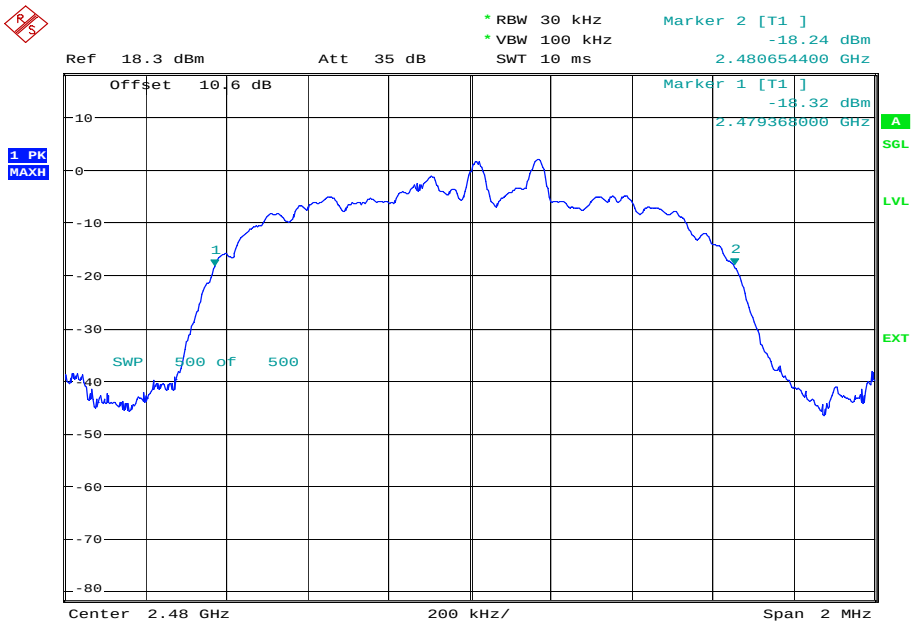
3DH5



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Product Service

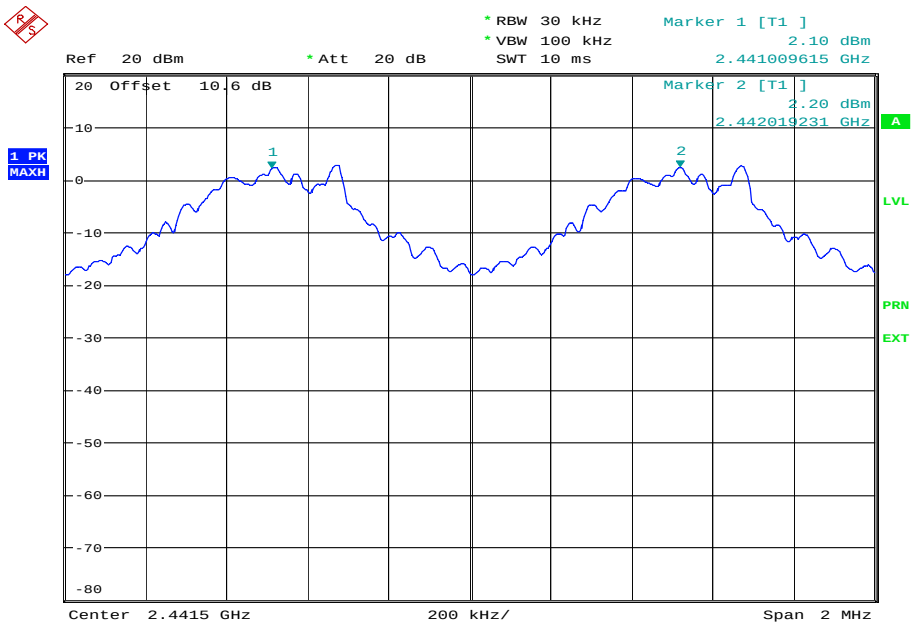
Limit Clause

Frequency hopping systems operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 0.125 W.

Channel Separation

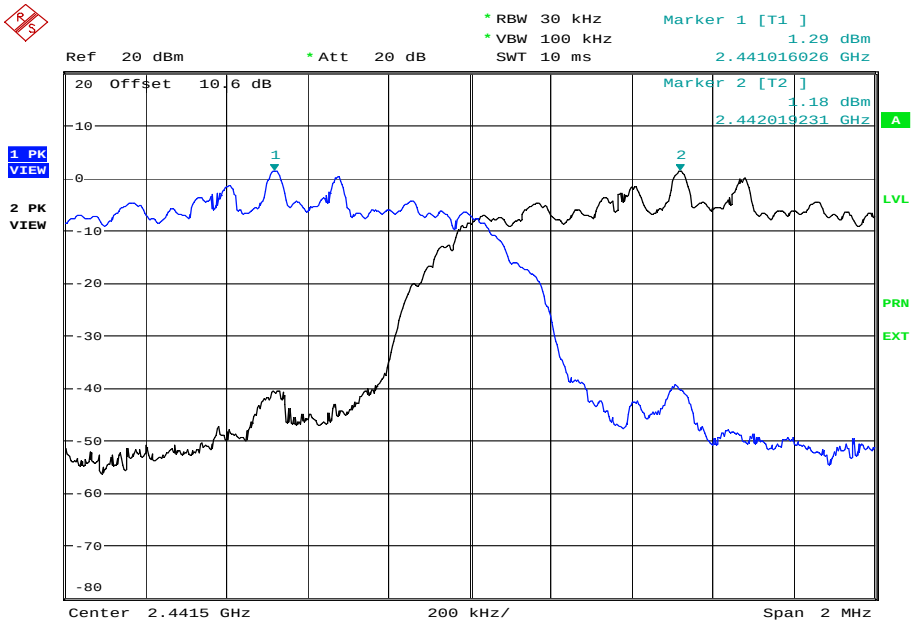
Modulation/Packet Type	Channel Separation (MHz)
GFSK/DH5	1.010
pi/4 DQPSK/2DH5	1.003
8-DPSK/3DH5	1.003

DH5



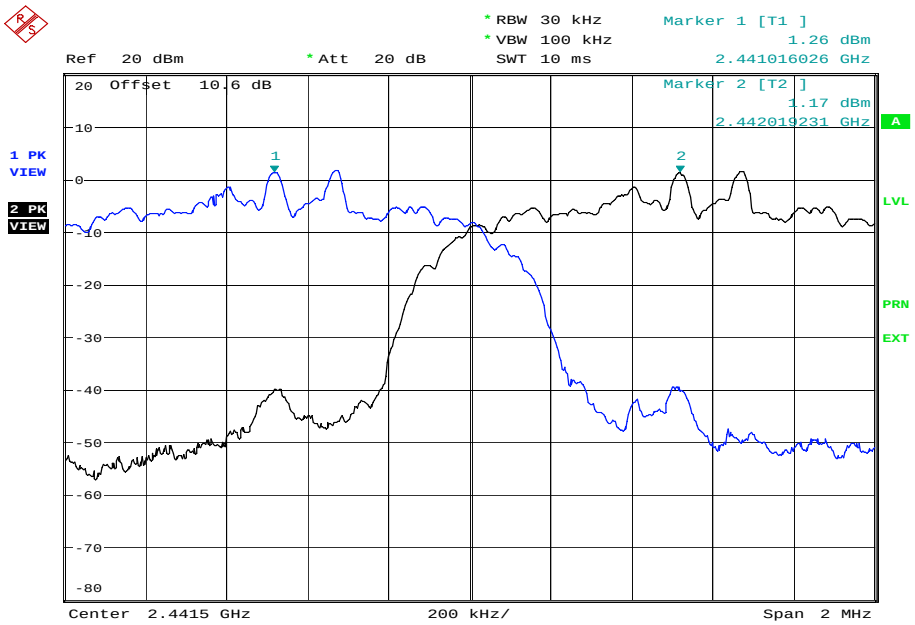
Product Service

2DH5



Date: 24.NOV.2014 12:37:41

3DH5



Date: 24.NOV.2014 12:39:35

Limit Clause

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Alternatively, frequency hopping systems operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 0.125 W.

The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Product Service

2.3 FREQUENCY HOPPING SYSTEMS - CHANNEL DWELL TIME AND NUMBER OF HOPPING CHANNELS

2.3.1 Specification Reference

FCC CFR 47 Part 15C, Clause 15.247 (a)(1)(iii)

2.3.2 Equipment Under Test and Modification State

S/N: IMEI 004401115303444 - Modification State 0

2.3.3 Date of Test

24 November 2014

2.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.5 Test Procedure

The test was applied in accordance with the test method requirements of ANSI C63.10 2009 section 7.7.

The EUT was transmitted at maximum power and hopping on the maximum number of supported hopping channels for DH1, DH3 and DH5 packet types.

The analyser was set to zero span at the centre frequency of a supported channel by the EUT. The analyser was configured with an RBW of 1 MHz and VBW of 3 MHz. The Tx on time of a single hop was measured with a reduced sweep time. The sweep time was then set to the observation period defined in 15.247(a) and the number of transmissions was recorded. The average dwell time was then calculated from the product of the Tx-on time per hop and the number of transmissions observed.

To verify that the EUT employed a minimum of 15 hopping channels, the span was adjusted to the entire frequency band of operation. The RBW was set to 100 kHz and VBW of 300 kHz. The EUT was configured with DH5 modulation hopping on the maximum number of supported channels.

2.3.6 Environmental Conditions

Ambient Temperature	20.7°C
Relative Humidity	31.5%

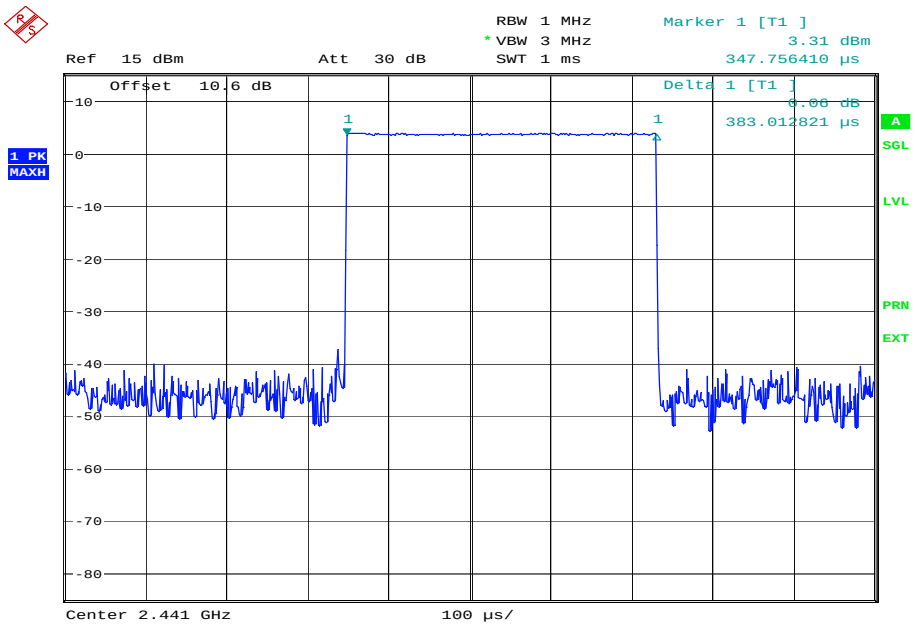
Product Service

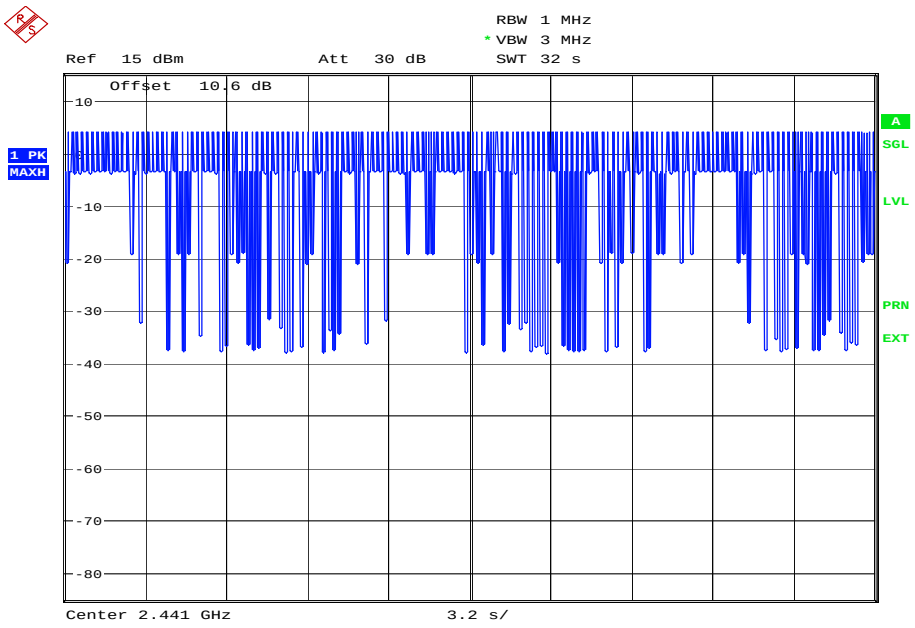
2.3.7 Test Results

Channel Dwell Time

DH1

Dwell Time (ms)	Number of Transmissions	Average Occupancy Time (ms)
64.729	169	0.383012

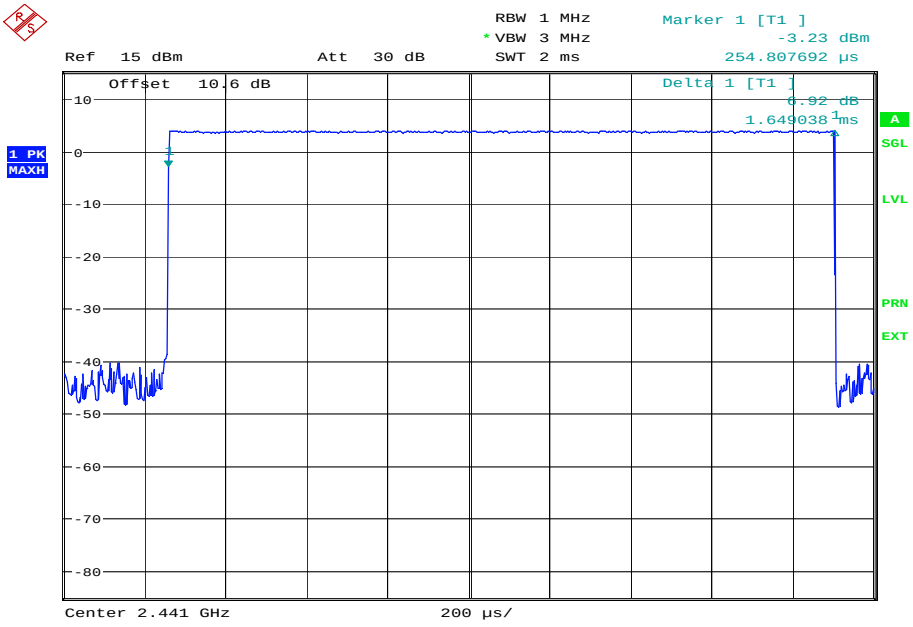




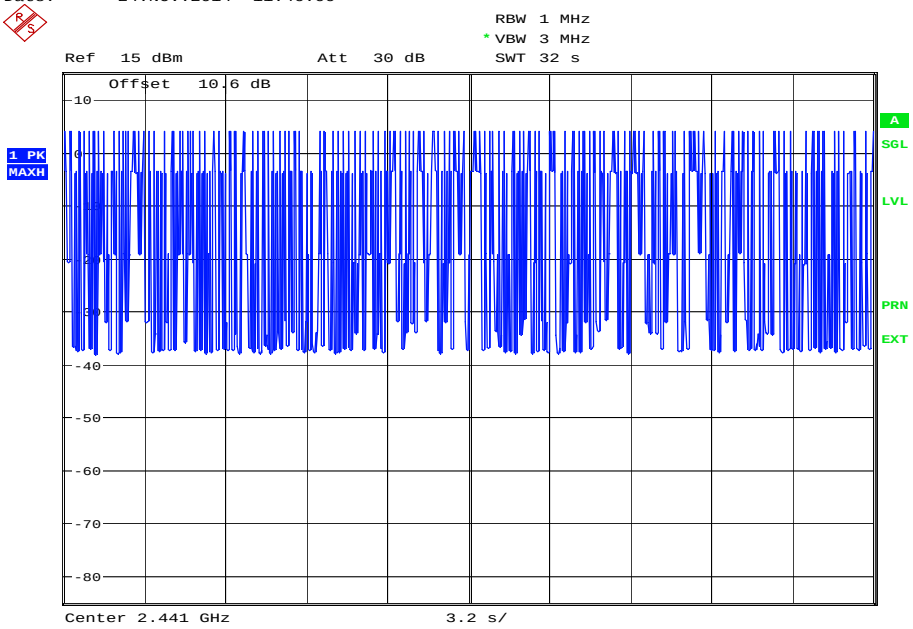
Date: 24.NOV.2014 11:41:35

DH3

Dwell Time (ms)	Number of Transmissions	Average Occupancy Time (ms)
212.725	129	1.649038



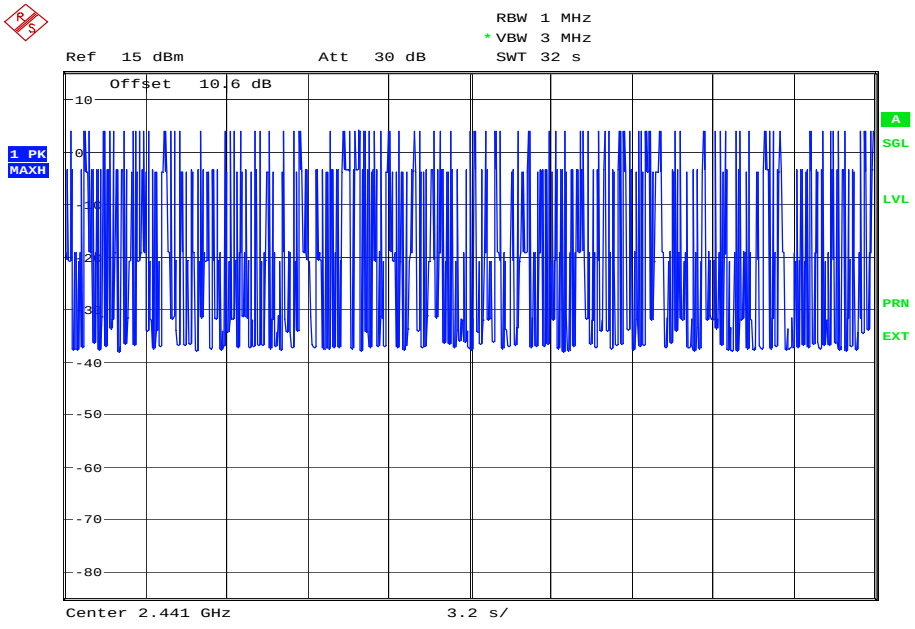
Date: 24.NOV.2014 11:46:00



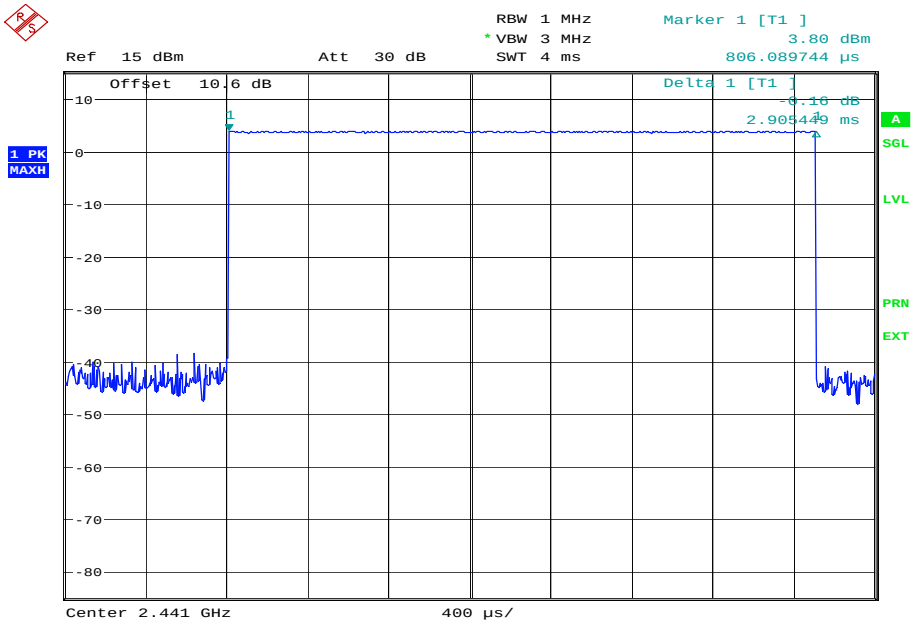
Date: 24.NOV.2014 11:40:20

DH5

Dwell Time (ms)	Number of Transmissions	Average Occupancy Time (ms)
258.585	89	2.905449



Date: 24.NOV.2014 11:42:47



Date: 24.NOV.2014 11:47:13

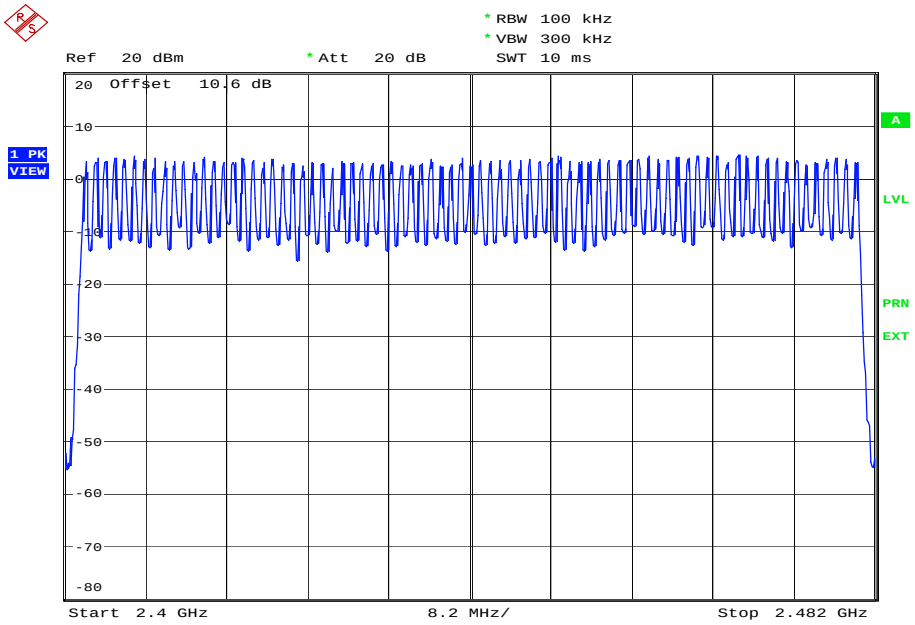
Limit

Frequency hopping systems operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.

Product Service

Number of Hopping Channels

79 channels



Date: 24.NOV.2014 11:50:14

Limit

≥ 15 channels

2.4 MAXIMUM PEAK CONDUCTED OUTPUT POWER

2.4.1 Specification Reference

FCC CFR 47 Part 15C, Clause 15.247 (b)(3)

2.4.2 Equipment Under Test and Modification State

S/N: IMEI 004401115303444 - Modification State 0

2.4.3 Date of Test

24 November 2014

2.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.5 Test Procedure

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 15.247 (b) and KDB 558074.

The EUT was connected to a broadband peak RF power meter via a cable and attenuator. The EUT was transmitting at maximum power, for bottom, middle and top channels. The path loss between the EUT and sensor was measured and entered as a reference level offset. The peak power was recorded for measurements on the bottom, middle and top channels.

2.4.6 Environmental Conditions

Ambient Temperature	20.7°C
Relative Humidity	31.5%

Product Service

2.4.7 Test Results

4.0 V DC Supply

Packet Type	Maximum Peak Conducted Output Power					
	dBm			mW		
	2402 MHz	2441 MHz	2480 MHz	2402 MHz	2441 MHz	2480 MHz
DH1	4.21	4.15	4.48	2.64	2.60	2.81
DH3	4.14	4.08	4.41	2.59	2.56	2.76
DH5	4.16	4.05	4.39	2.61	2.54	2.75

Limit Clause

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non overlapping hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1 Watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 Watts.

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

2.5 EIRP PEAK POWER

2.5.1 Specification Reference

FCC CFR 47 Part 15C, Clause 15.247 (b)(4)

2.5.2 Equipment Under Test and Modification State

S/N: IMEI 004401115303378 - Modification State 0

2.5.3 Date of Test

27 November 2014

2.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.5 Test Procedure

A test environment and testing arrangement meeting the specification of ANSI C63.4 was used during all testing. The Equipment Under Test (EUT) was set upon a non-conducting platform during testing. The EUT elevation was 80 cm above the horizontal reference ground plane. The Analyser settings were adjusted to display the resultant trace on screen and a wideband power meter was used to perform the peak measurement. A spectrum analyser was used to display the level on the screen and this level was maximised by rotating the EUT through 360° and a height search of the measuring antenna. A substitution was then performed using a suitable calibrated antenna and signal generator.

This level was maximised by adjusting the height of the measuring antenna once more. The level from the signal generator was then adjusted to achieve the same raw result as with the EUT. This level was then corrected to account for cable loss and antenna factor.

2.5.6 Environmental Conditions

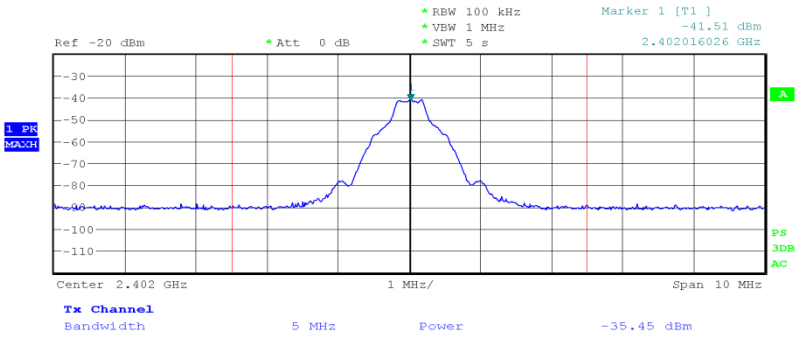
Ambient Temperature	20.0°C
Relative Humidity	50.0%

Product Service

2.5.7 Test Results

2402 MHz

EIRP (dBm)	EIRP (mW)
0.79	1.20

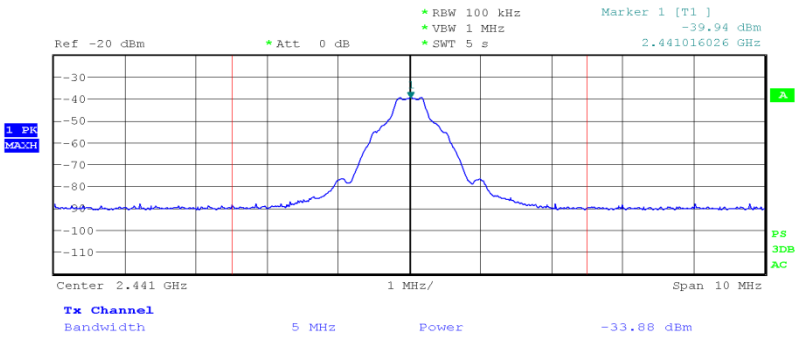


Date: 26.NOV.2014 13:46:20

Product Service

2441 MHz

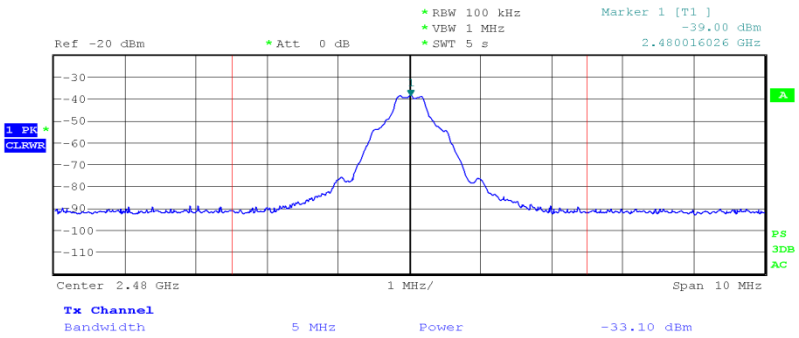
EIRP (dBm)	EIRP (mW)
2.84	1.92



Date: 26.NOV.2014 13:14:55

2480 MHz

EIRP (dBm)	EIRP (mW)
2.75	1.88



Date: 26.NOV.2014 14:24:00

Limit

EIRP (dBm)	EIRP (mW)
36.0	4000

Product Service

2.6 SPURIOUS AND BAND EDGE EMISSIONS

2.6.1 Specification Reference

FCC CFR 47 Part 15C, Clause 15.247 (d)

2.6.2 Equipment Under Test and Modification State

S/N: IMEI 004401115303352 - Modification State 0 and 1

2.6.3 Date of Test

26 November 2014, 27 November 2014, 2 December 2014 & 12 December 2014

2.6.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.6.5 Test Procedure

When frequencies less than 18 GHz were measured; the EUT elevation was 80 cm above the horizontal reference ground plane. When frequencies greater than 18 GHz were measured; the EUT elevation was 1 m above the horizontal reference ground plane to ensure adequate vertical beam width coverage of the measuring antenna with respect to the EUT.

The horizontal reference ground plane encompasses a turntable which is used to adjust the azimuth of the EUT. An antenna positioner is used to elevate the measuring antenna above the horizontal reference ground plane whereby the antenna elevation is adjustable between 1 m and 4 m.

To ascertain the azimuth and measuring antenna polarization that yields the highest peak emission level, each final measurement frequency was investigated by continuous azimuth emissions searching with the measuring antenna in both vertical and horizontal polarizations. For each final measurement frequency, the respective peak emission azimuth and measuring antenna polarization was used during a measuring antenna elevation search from 1 m to 4 m. Each final measurement frequency was then measured with the EUT azimuth, measuring antenna height and polarization that yielded the greatest peak emission level.

Spurious Emissions

The EUT was set to operate at maximum power on the bottom, middle and top channels for the data rate which resulted in the highest conducted average output power. The power of each fundamental frequency was measured in 100 kHz RBW, the resultant limit line on the trace was set at -20 dBc of this value. Measurements were performed from 30 MHz to 25 GHz and the path loss is incorporated as a transducer factor and entered into the spectrum analyser.

Exploratory radiated emissions measurements were made by azimuth emissions searches over a range of 0° and 360°. These exploratory radiated emissions measurements were made using a peak detector over a frequency range of 30 MHz to 25 GHz, with the measuring antenna in both vertical and horizontal polarizations.

Final measurement points over the frequency range of 30 MHz to 1 GHz were measured using a quasi-peak detector. Final measurement points over the frequency range of 1 GHz and 25 GHz were measured using peak and average methods. Peak measurements were made using a peak detector with 1 MHz resolution and video bandwidths. Average measurements were made using a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz.

All final measurements were assessed against the Class B emission limits in Clause 15.209 of FCC CFR 47 FCC Part 15.

Band Edge

Measurements were performed with the EUT operating in hopping and static modes for the modulation/packet type determined to give the highest conducted average output power and the modulation/packet type determined to result in the widest 20 dB bandwidth.
Measurements at the authorized band edges have been made in accordance with ANSI C63.10 clause 7.7.9. Measurements have also been performed at the restricted band edges where peak measurements have used an RBW of 1MHz and with peak detector/max hold. The VBW was reduced to 10 Hz for average measurements.

2.6.6 Environmental Conditions

Ambient Temperature	18.3 - 19.9°C
Relative Humidity	34.0 - 47.0%

Product Service

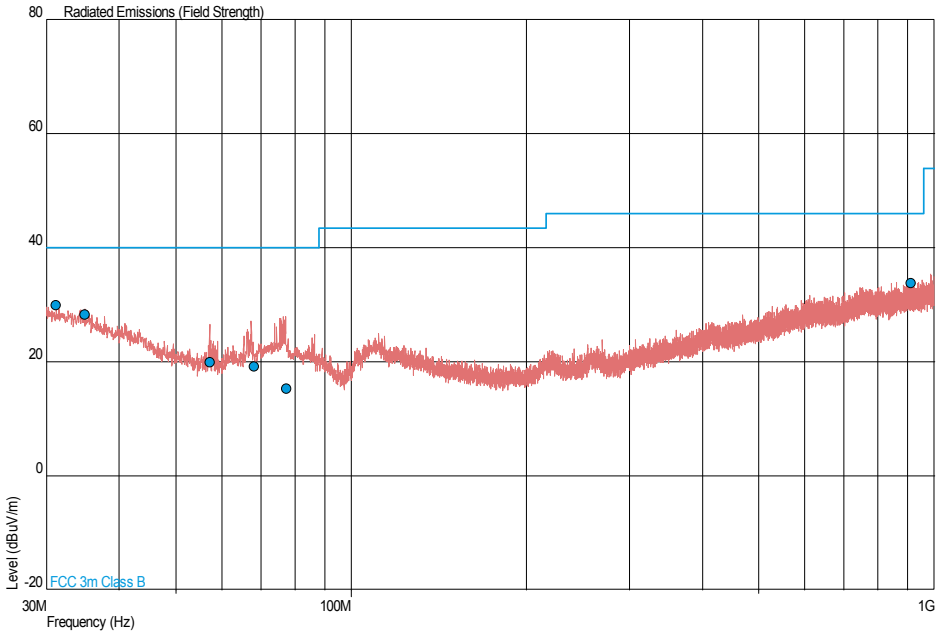
2.6.7 Test Results

4.0 V DC Supply

Spurious Radiated Emissions

2402 MHz

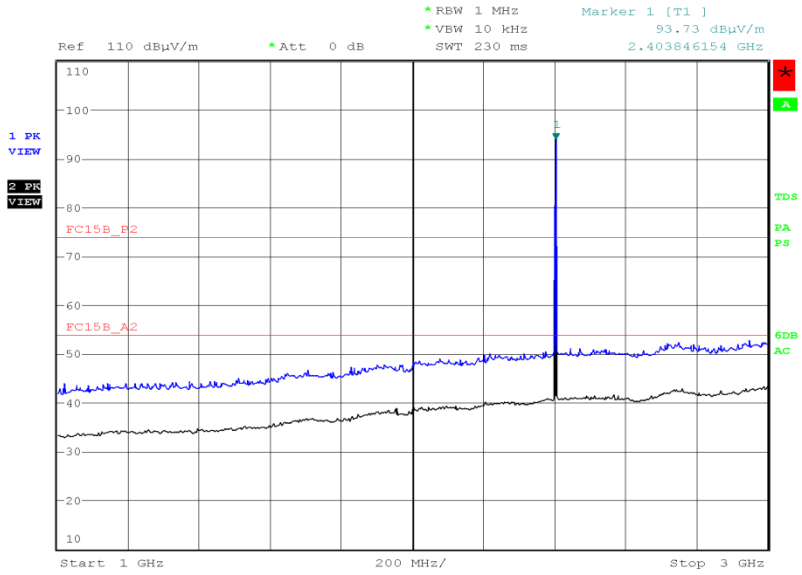
30 MHz to 1 GHz



Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
31.225	29.9	31.3	40.0	100	-10.1	-68.7	311	1.00	Vertical
34.996	28.4	26.3	40.0	100	-11.6	-73.7	236	1.00	Vertical
57.206	19.9	9.9	40.0	100	-20.1	-90.1	1	1.36	Vertical
68.292	19.2	9.1	40.0	100	-20.8	-90.9	313	1.00	Vertical
77.569	15.2	5.8	40.0	100	-24.8	-94.2	0	1.00	Horizontal
912.828	33.8	49.0	46.0	200	-12.2	-151.0	171	1.00	Vertical

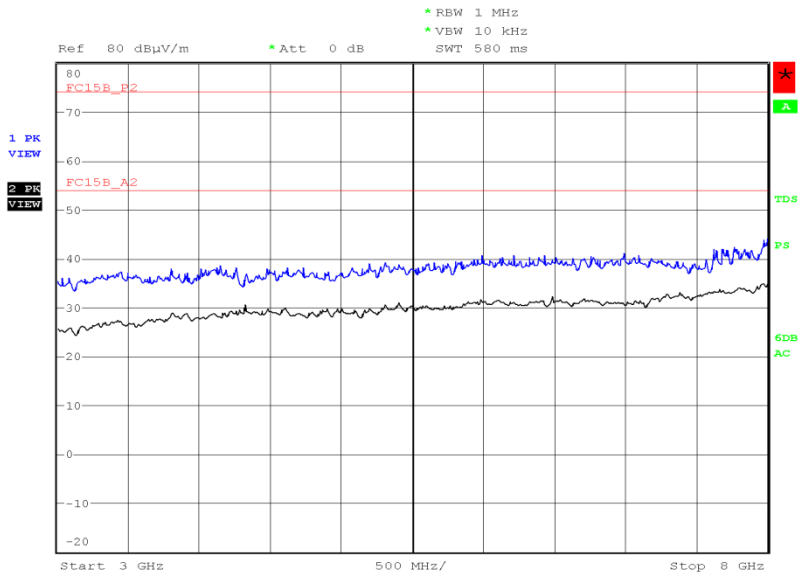
Product Service

1 GHz to 3 GHz



Date: 26.NOV.2014 15:36:47

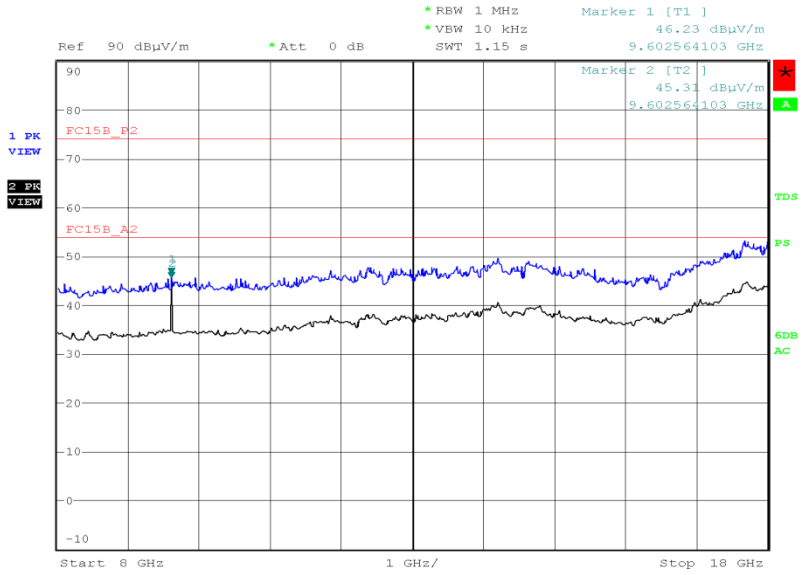
3 GHz to 8 GHz



Date: 27.NOV.2014 12:58:02

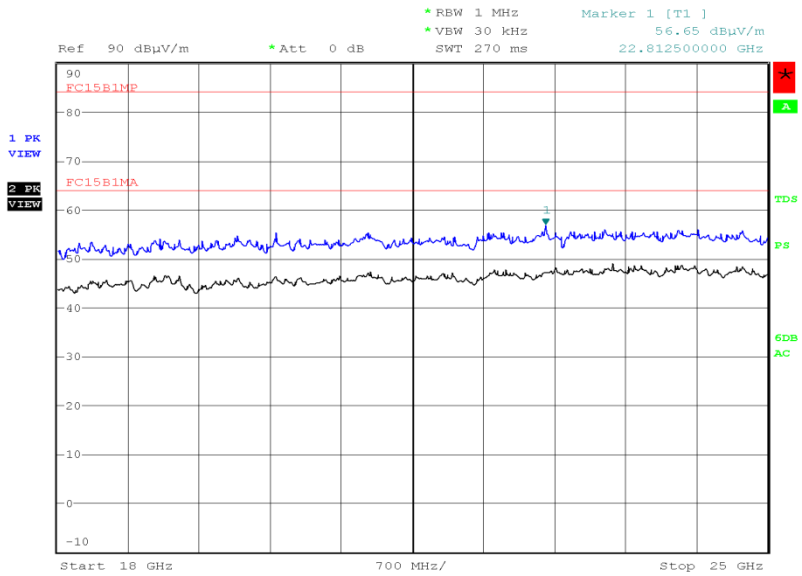
Product Service

8 GHz to 18 GHz



Date: 27.NOV.2014 15:09:09

18 GHz to 25 GHz



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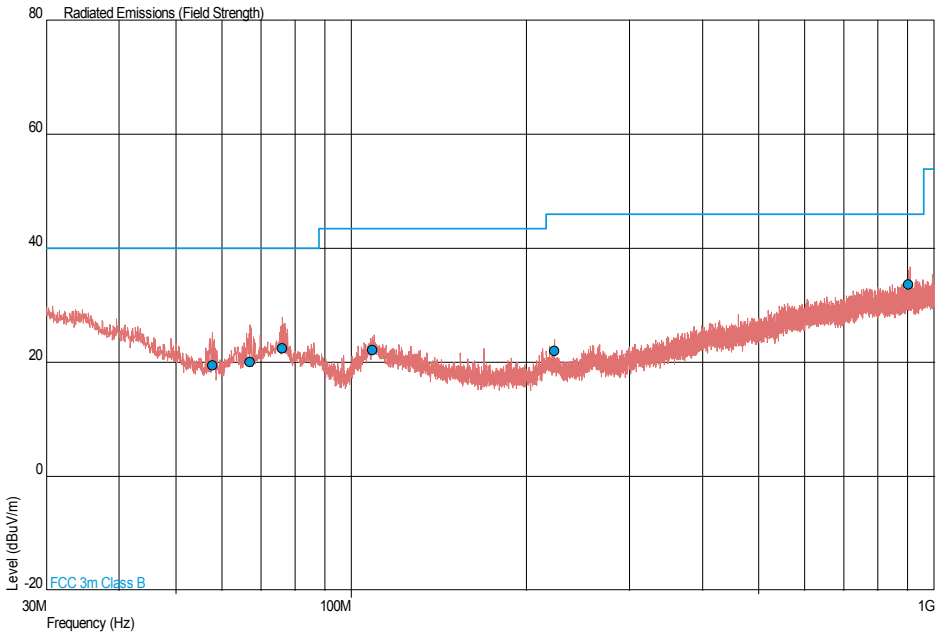
2441 MHz

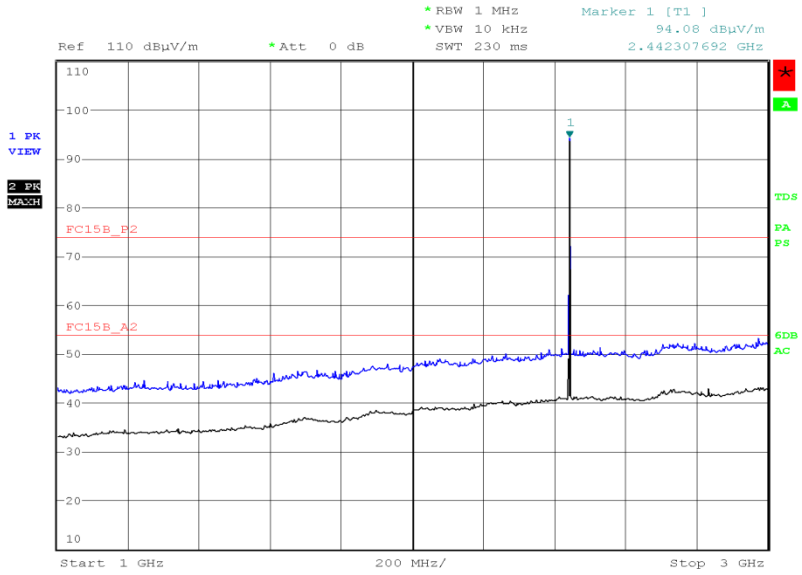
30 MHz to 1 GHz



Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
57.789	19.4	9.3	40.0	100	-20.6	-90.7	90	1.00	Vertical
67.054	20.1	10.1	40.0	100	-19.9	-89.9	360	1.00	Vertical
76.316	22.4	13.2	40.0	100	-17.6	-86.8	105	1.00	Vertical
108.855	22.2	12.9	43.5	150	-21.3	-137.1	79	1.00	Vertical
222.985	22.0	12.6	46.0	200	-24.0	-187.4	181	1.00	Horizontal
902.321	33.7	48.4	46.0	200	-12.3	-151.6	11	2.60	Vertical

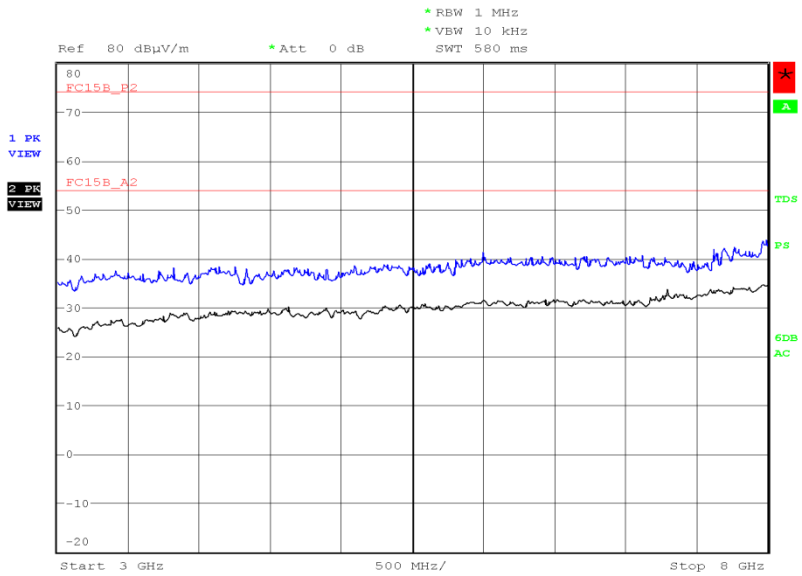
Product Service

1 GHz to 3 GHz



Date: 26.NOV.2014 15:43:49

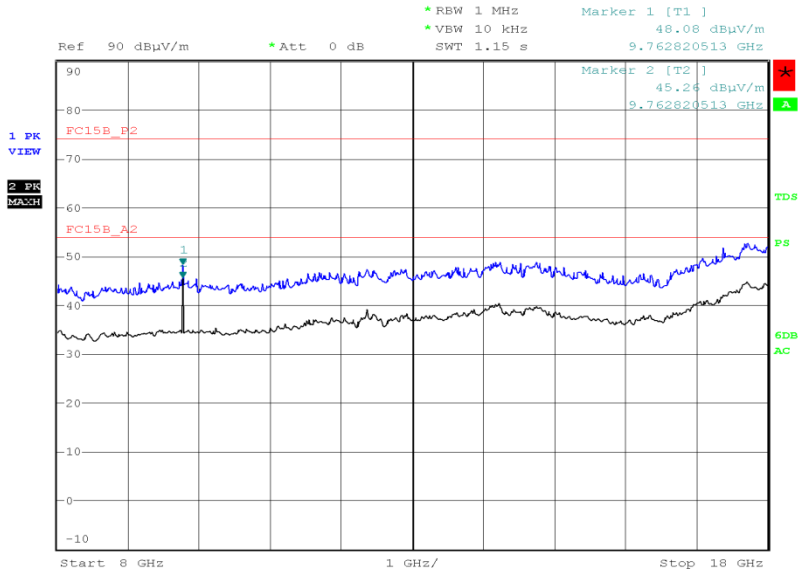
3 GHz to 8 GHz



Date: 27.NOV.2014 13:11:00

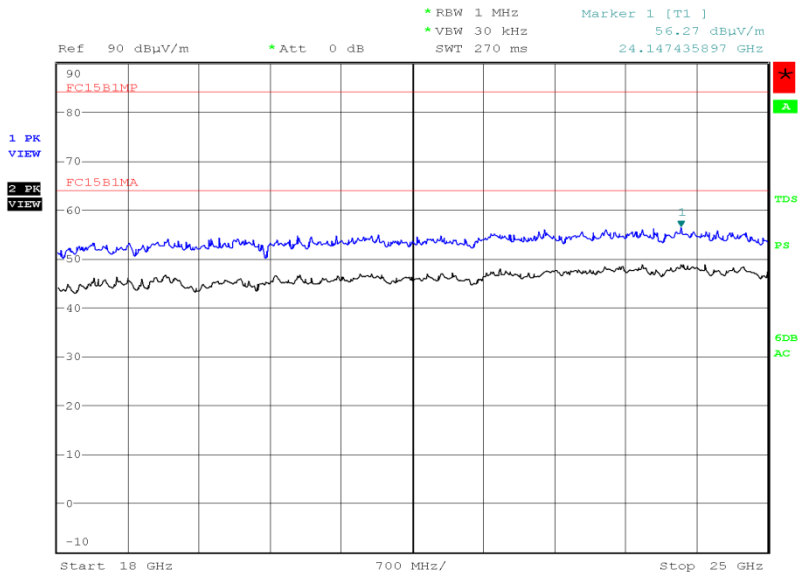
Product Service

8 GHz to 18 GHz



Date: 27.NOV.2014 14:21:21

18 GHz to 25 GHz



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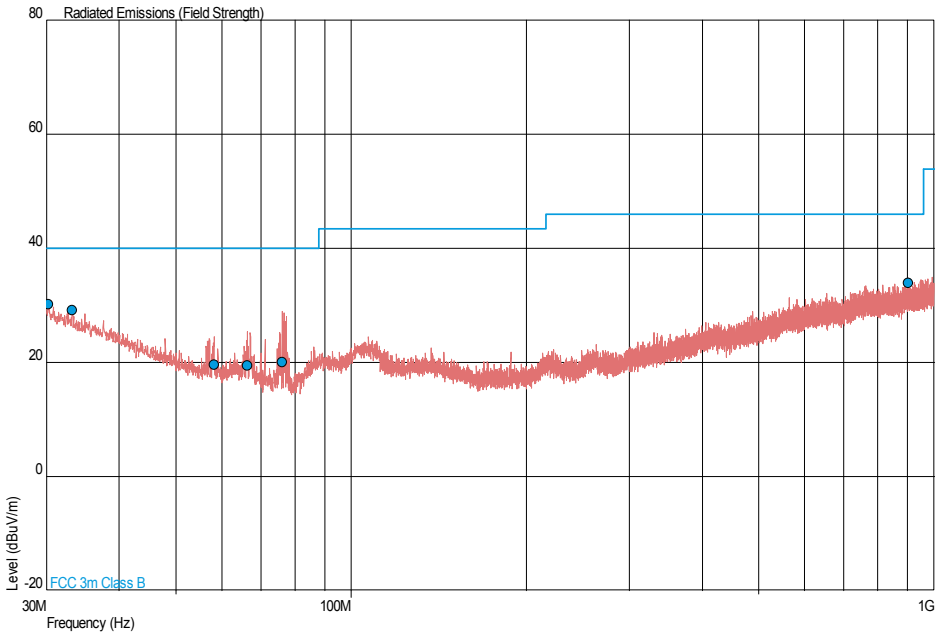
2480 MHz

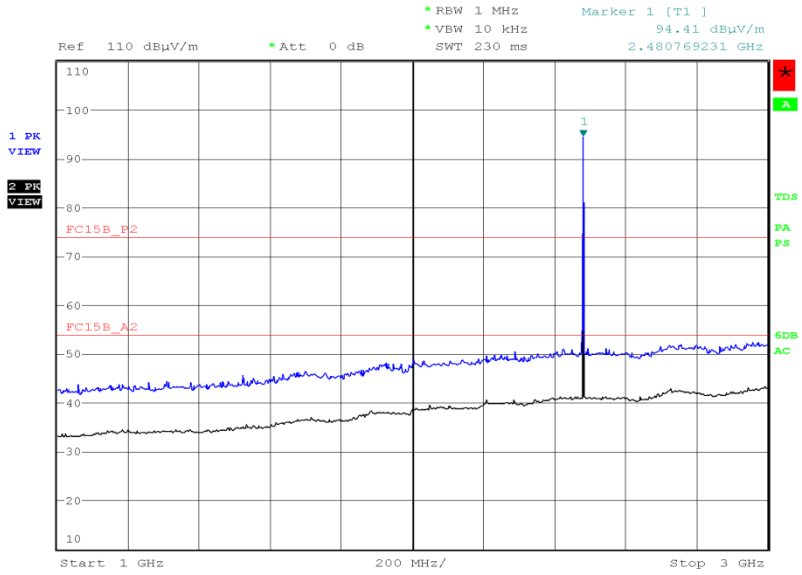
30 MHz to 1 GHz



Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.243	30.2	32.4	40.0	100	-9.8	-67.6	360	1.00	Vertical
33.250	29.2	28.8	40.0	100	-10.8	-71.2	55	1.03	Vertical
58.227	19.6	9.5	40.0	100	-20.4	-90.5	358	1.02	Vertical
66.376	19.4	9.3	40.0	100	-20.6	-90.7	295	1.00	Vertical
76.133	20.1	10.1	40.0	100	-19.9	-89.9	303	1.00	Vertical
902.321	33.9	49.5	46.0	200	-12.1	-150.5	77	1.08	Horizontal

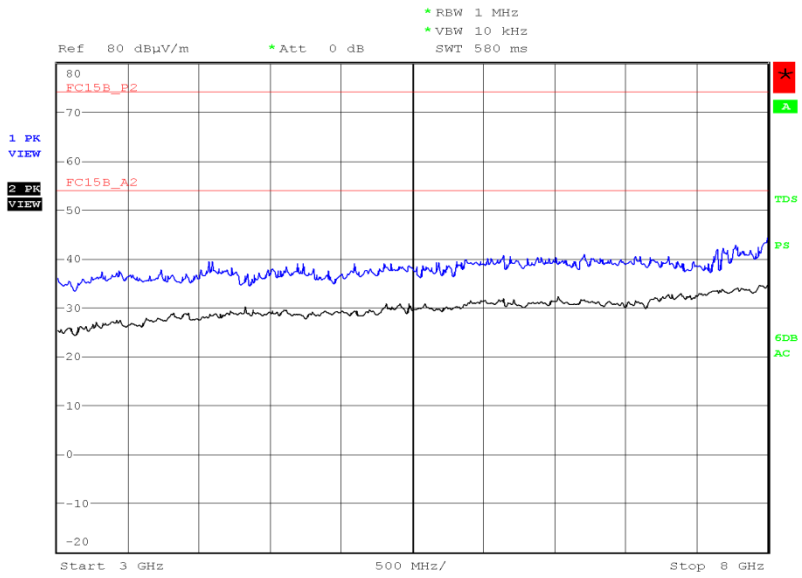
Product Service

1 GHz to 3 GHz



Date: 26.NOV.2014 15:59:02

3 GHz to 8 GHz



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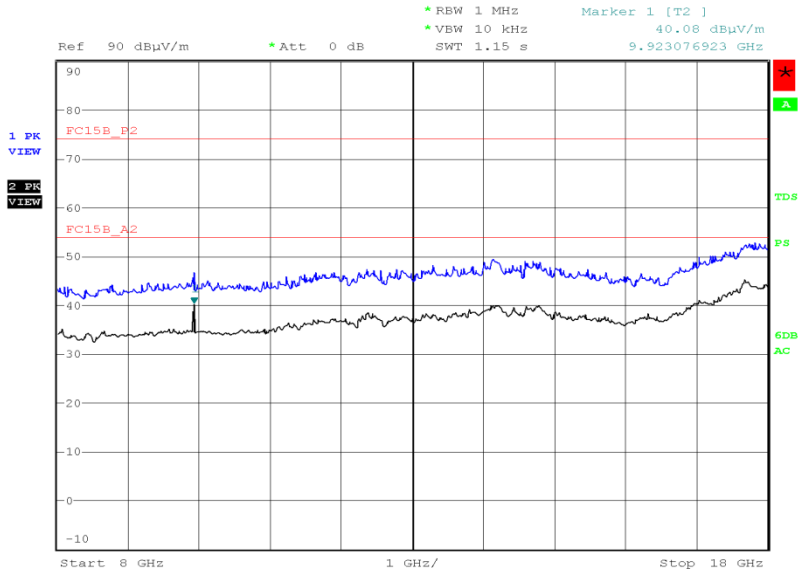
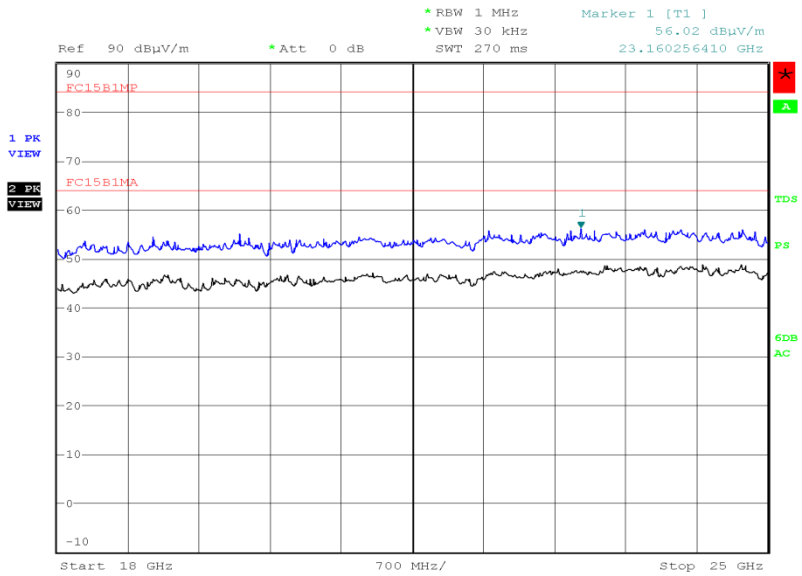
Product Service

8 GHz to 18 GHz



Date: 27.NOV.2014 14:15:47

18 GHz to 25 GHz



Date: 27.NOV.2014 17:07:57

Limit

Frequency (MHz)	Field Strength			Measurement Distance (m)
	(µV/m)	Average (dBµV/m)	Peak (dBµV/m)	
30-88	100	40.0	60.0	3
88-216	150	43.5	63.5	3
216-960	200	46.0	66.0	3
Above 960	500	54.0	74.0	3

Radiated Emissions which fall only in the restricted bands as defined in 15.205 must also comply with the limits in the table above. The table above does not apply for Radiated Emissions which fall outside the restricted bands as defined in 15.205. These emissions outside the restricted bands shall be at least 20 dB below the fundamental measured in a 100 kHz bandwidth using a peak detector. If the transmitted complies with the conducted power limits, based on the use of RMS averaging over a time interal, the attenuator required shall be 30 dB below the fundamental instead on 20 dB.

Band Edge Emissions

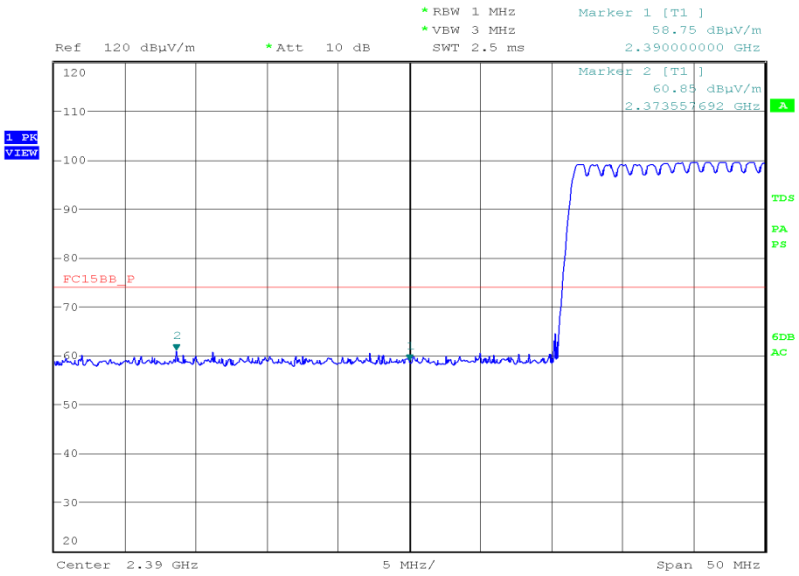
Hopping Mode

Modulation/Packet Type: GFSK/DH1

Restricted Bands of Operation		
Frequency (MHz)	Final Peak (dBµV/m)	Final Average (dBµV/m)
2390.00	60.85	47.65
2483.50	58.57	47.57

2390.00 MHz

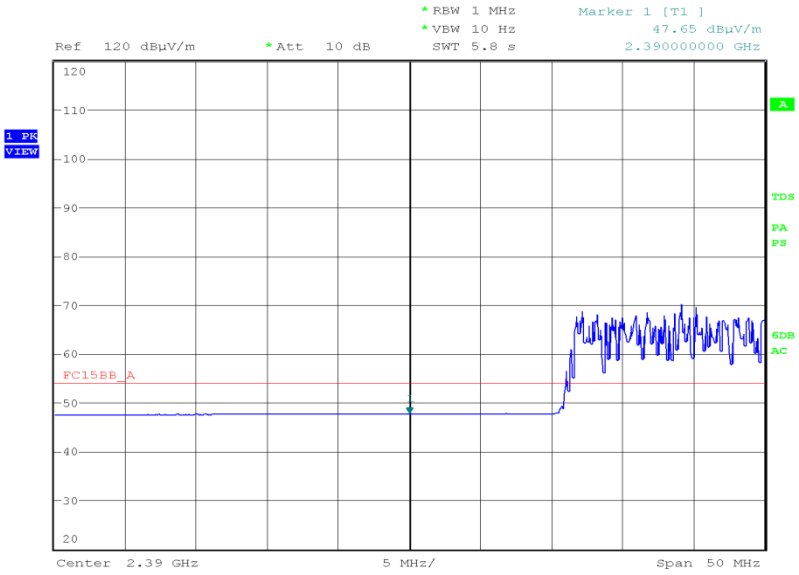
Final Peak



Date: 28.NOV.2014 18:30:45

Product Service

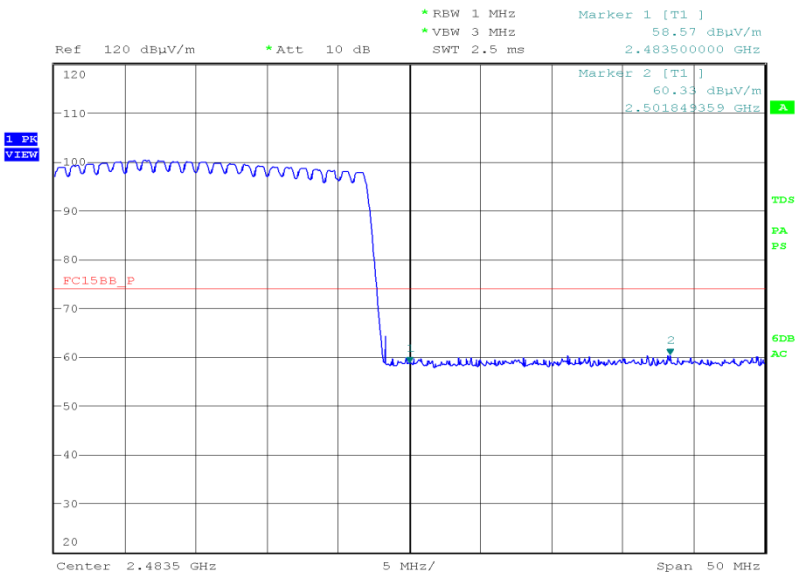
Final Average



Date: 28.NOV.2014 18:35:00

2483.50 MHz

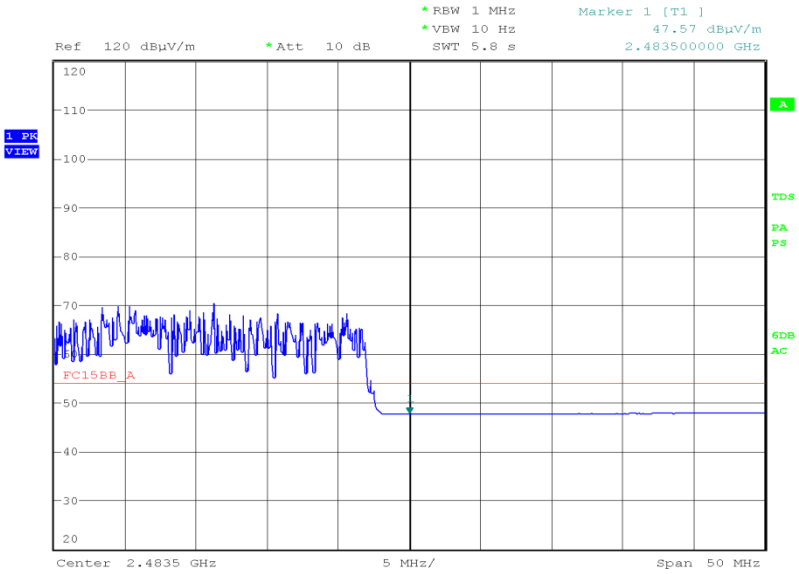
Final Peak



Date: 28.NOV.2014 18:37:59

Product Service

Final Average

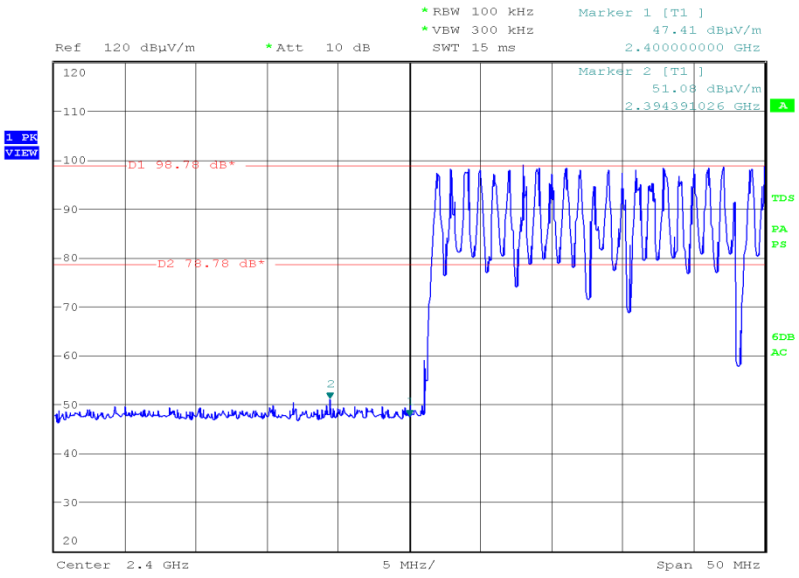


Date: 28.NOV.2014 18:36:35

Band Edge	
Frequency (MHz)	Final Peak (dBµV/m)
2400.00	51.08
2483.50	50.48

2400.00 MHz

Final Peak

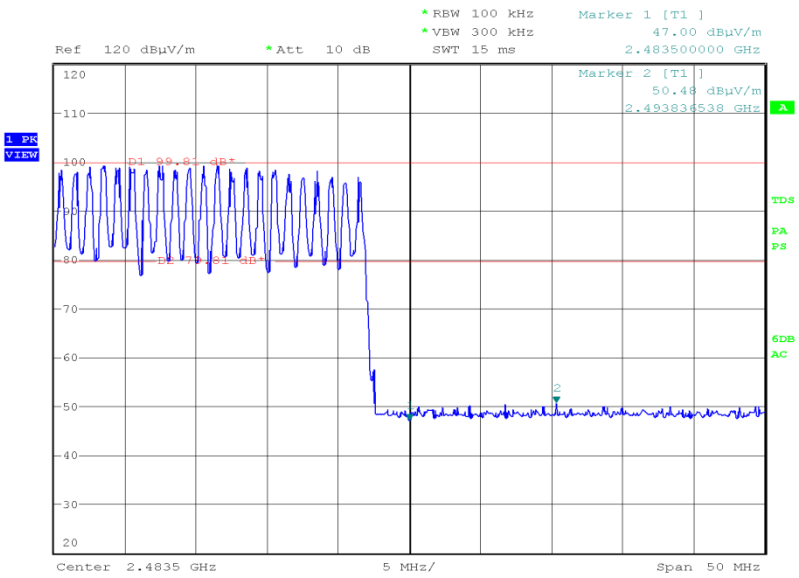


Date: 28.NOV.2014 18:27:21

Product Service

2483.50 MHz

Final Peak



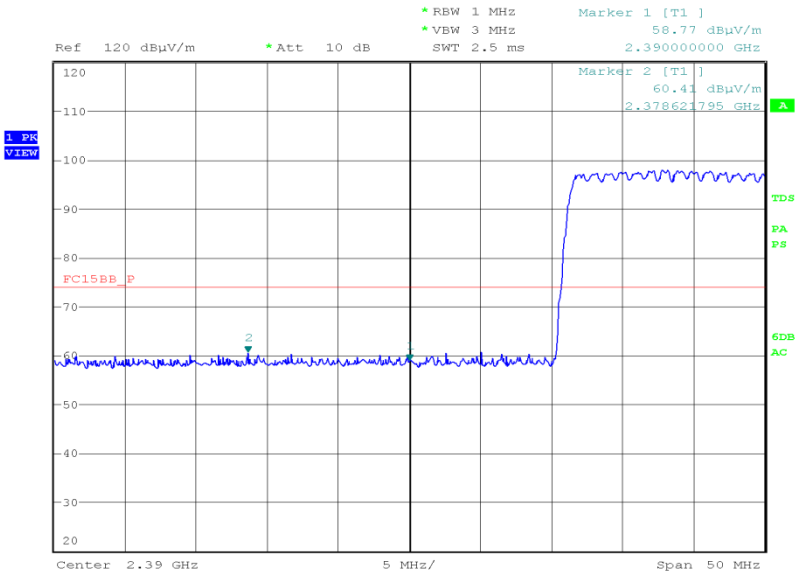
Date: 28.NOV.2014 19:08:07

Modulation/Packet Type: pi/4 DQPSK/2DH5

Restricted Bands of Operation		
Frequency (MHz)	Final Peak (dBµV/m)	Final Average (dBµV/m)
2390.00	60.41	47.83
2483.50	60.58	47.77

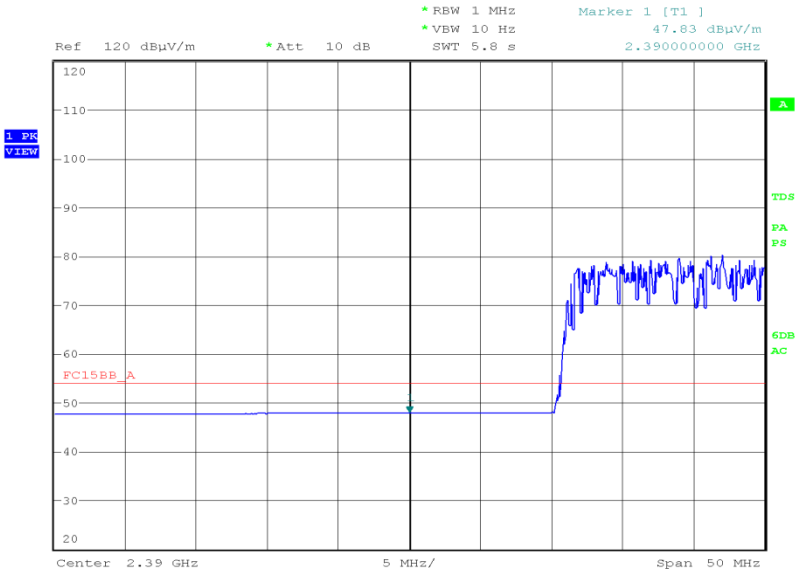
2390.00 MHz

Final Peak



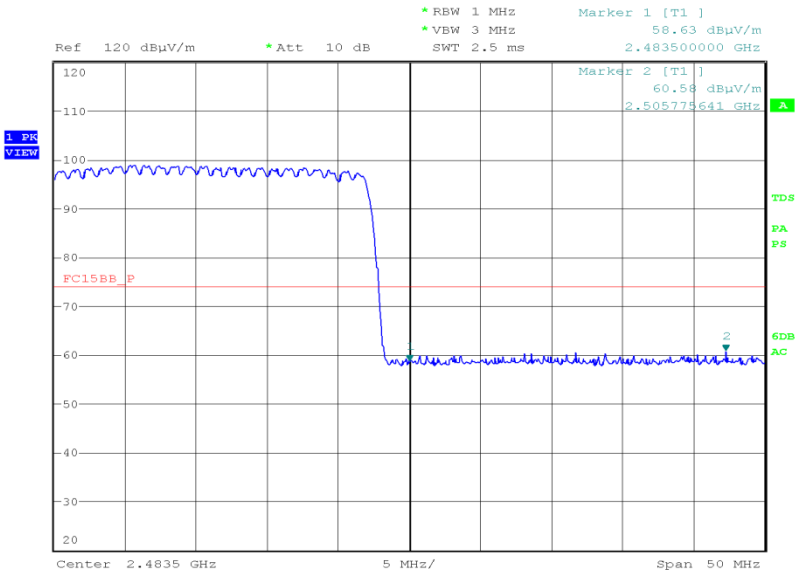
Date: 2.DEC.2014 10:46:50

Final Average



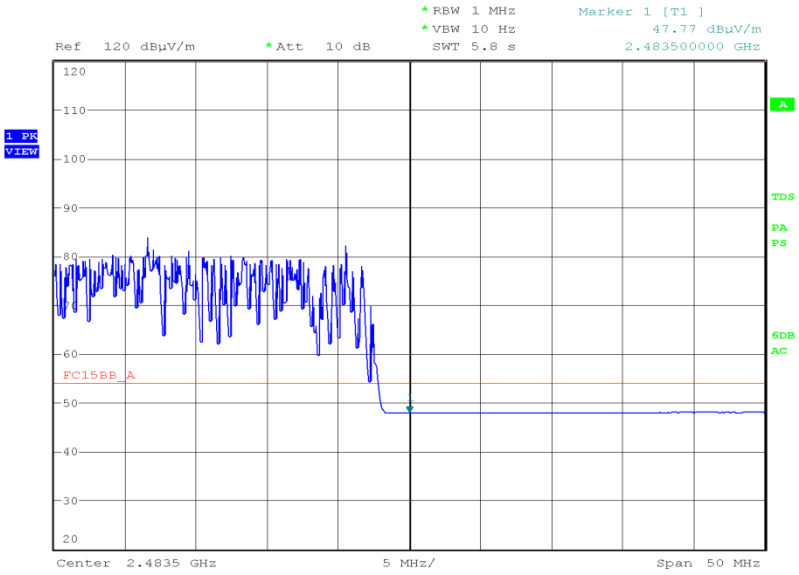
2483.50 MHz

Final Peak



Product Service

Final Average

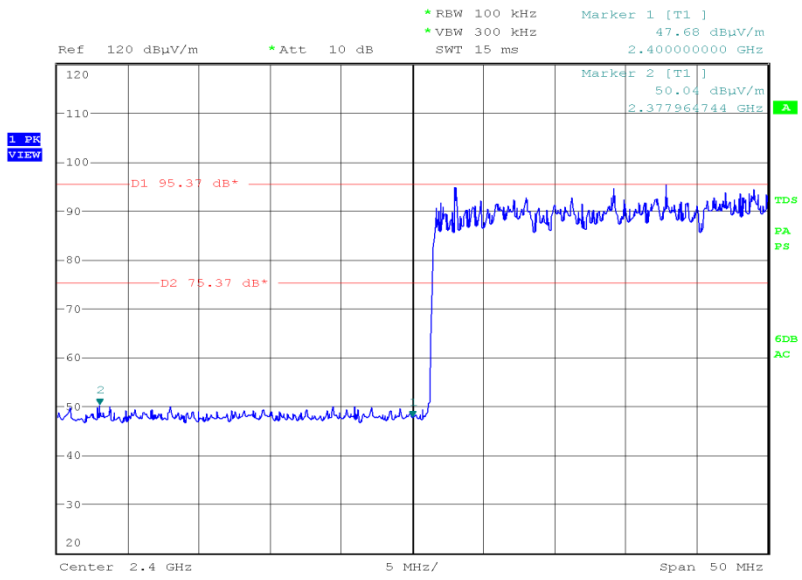


Date: 2.DEC.2014 10:43:01

Band Edge	
Frequency (MHz)	Final Peak (dBµV/m)
2400.00	50.04
2483.50	50.56

2400.00 MHz

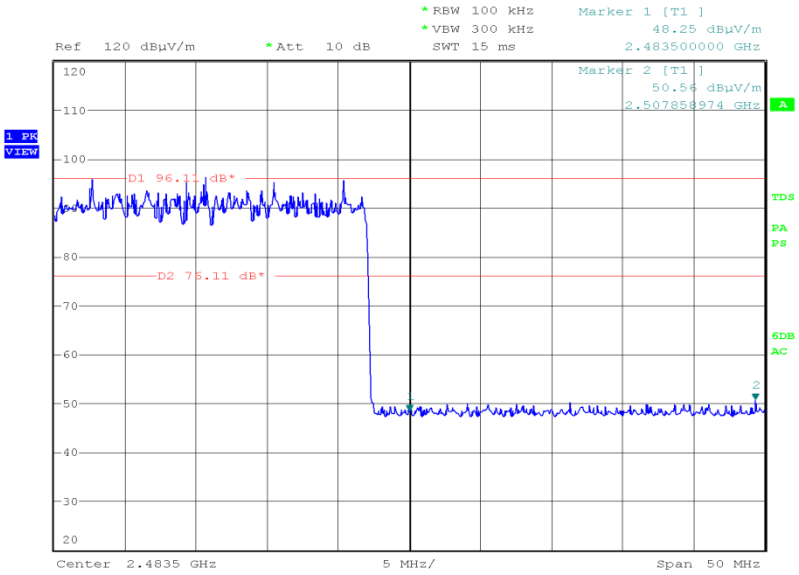
Final Peak



Product Service

2483.50 MHz

Final Peak



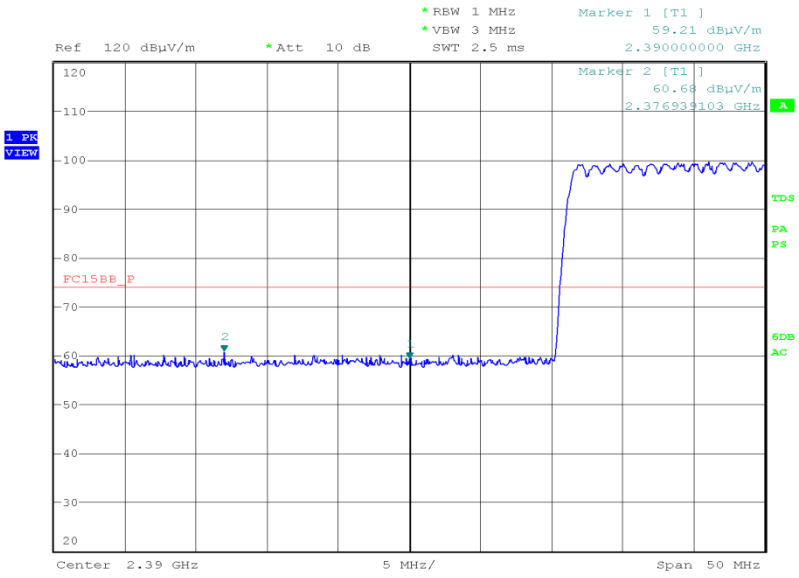
Date: 2.DEC.2014 10:34:39

Modulation/Packet Type: 8-DPSK/3DH5

Restricted Bands of Operation		
Frequency (MHz)	Final Peak (dBµV/m)	Final Average (dBµV/m)
2390.00	60.68	47.66
2483.50	60.54	47.54

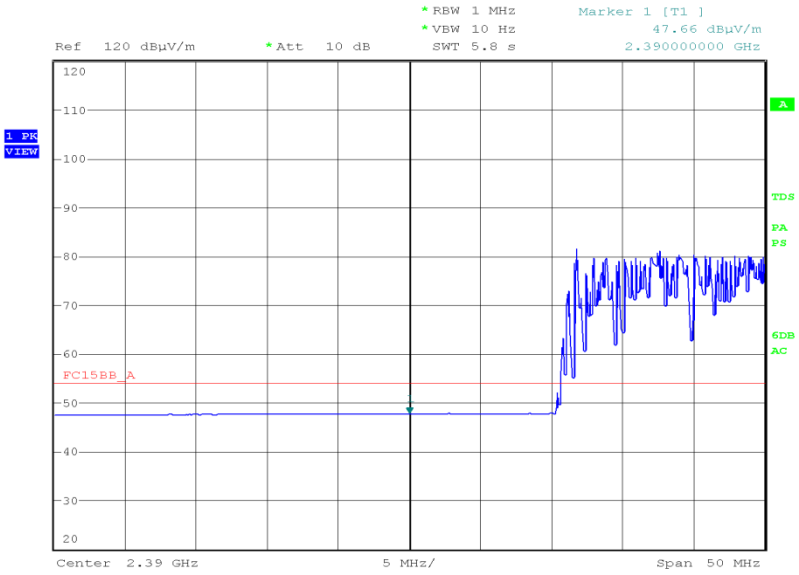
2390.00 MHz

Final Peak



Product Service

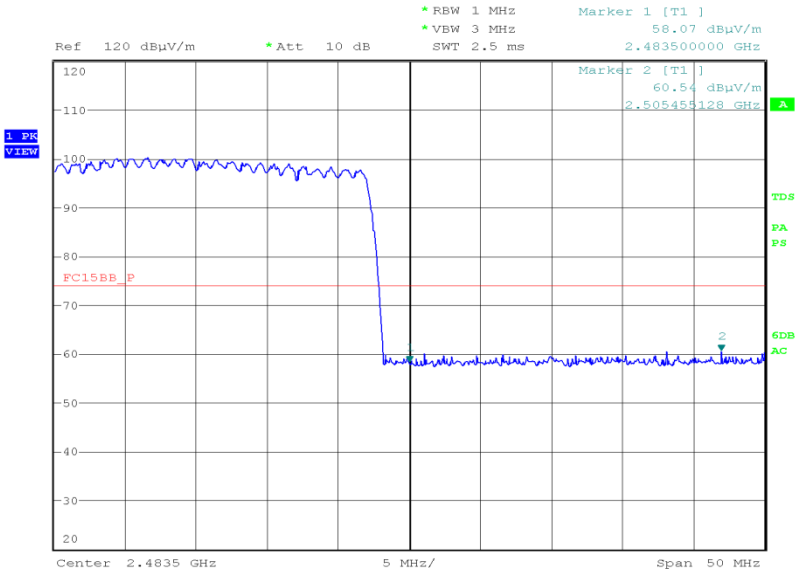
Final Average



Date: 28.NOV.2014 19:32:11

2483.50 MHz

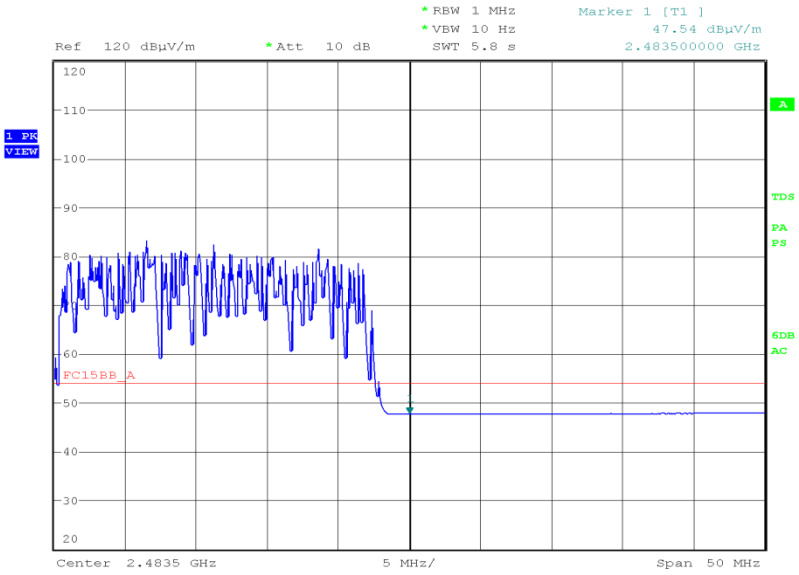
Final Peak



Date: 28.NOV.2014 19:24:59

Product Service

Final Average

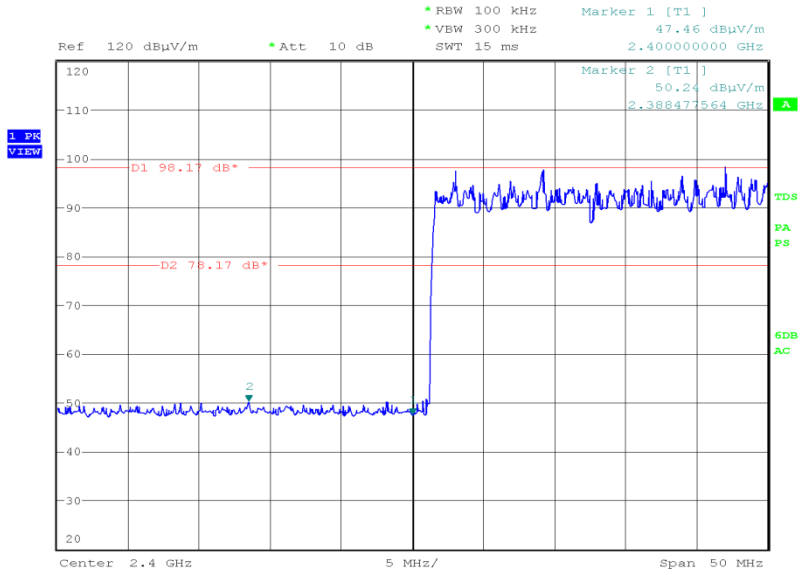


Date: 28.NOV.2014 19:26:49

Band Edge	
Frequency (MHz)	Final Peak (dBµV/m)
2400.00	50.24
2483.50	50.12

2400.00 MHz

Final Peak

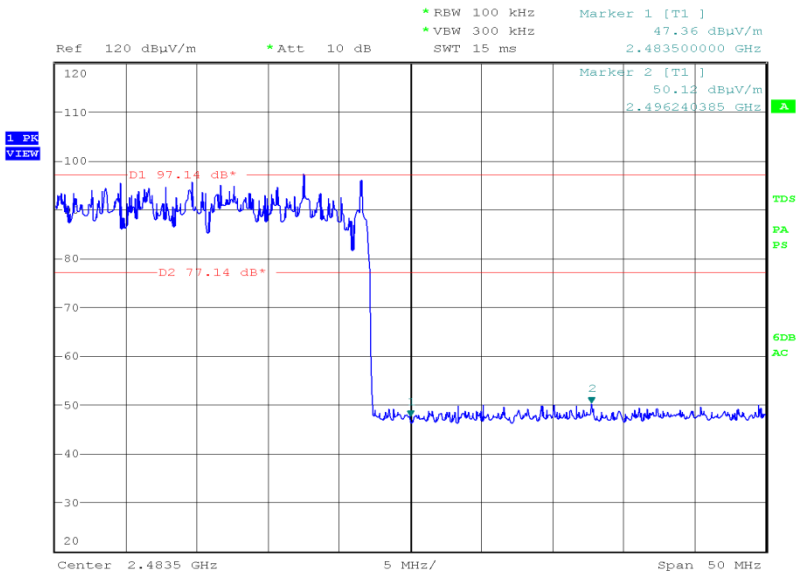


Date: 28.NOV.2014 19:48:47

Product Service

2483.50 MHz

Final Peak



Date: 28.NOV.2014 19:23:45

Band Edge Emissions

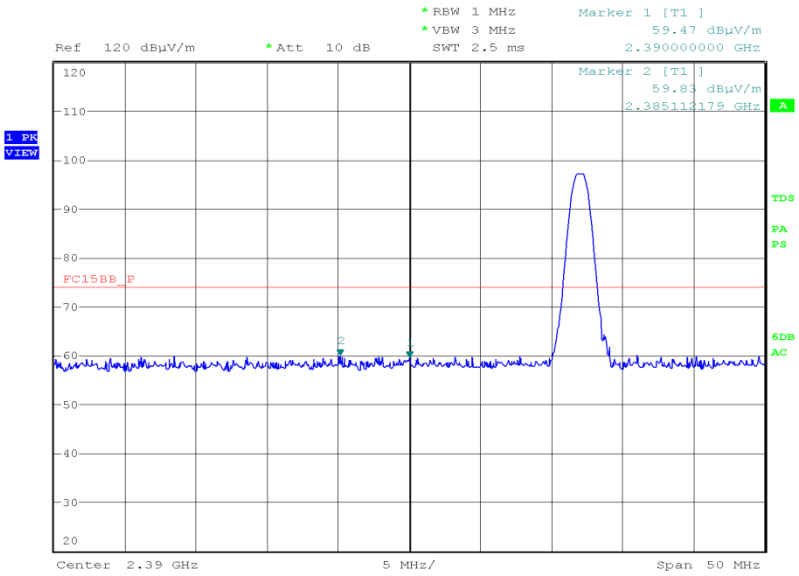
Static Mode

Modulation/Packet Type: GFSK/DH1

Restricted Bands of Operation		
Frequency (MHz)	Final Peak (dBµV/m)	Final Average (dBµV/m)
2390.00	59.83	47.82
2483.50	60.85	47.78

2390.00 MHz

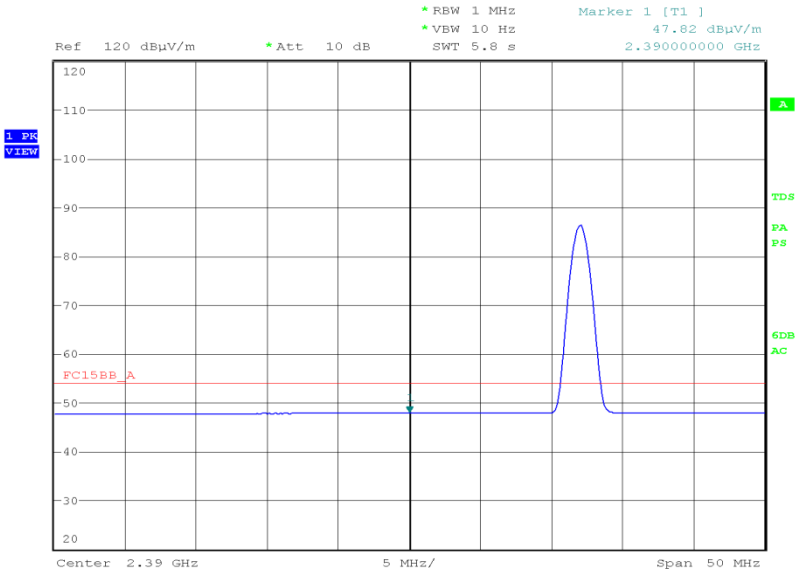
Final Peak



Date: 27.NOV.2014 10:19:09

Product Service

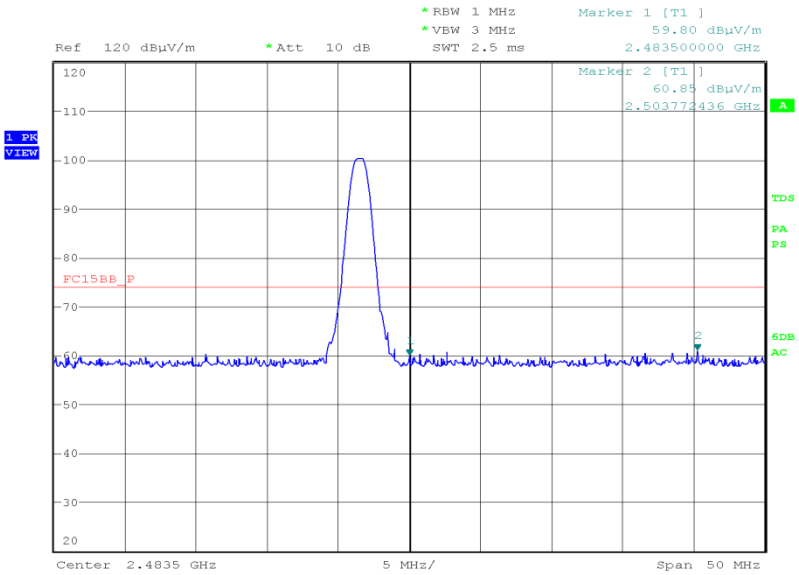
Final Average



Date: 27.NOV.2014 10:20:24

2483.50 MHz

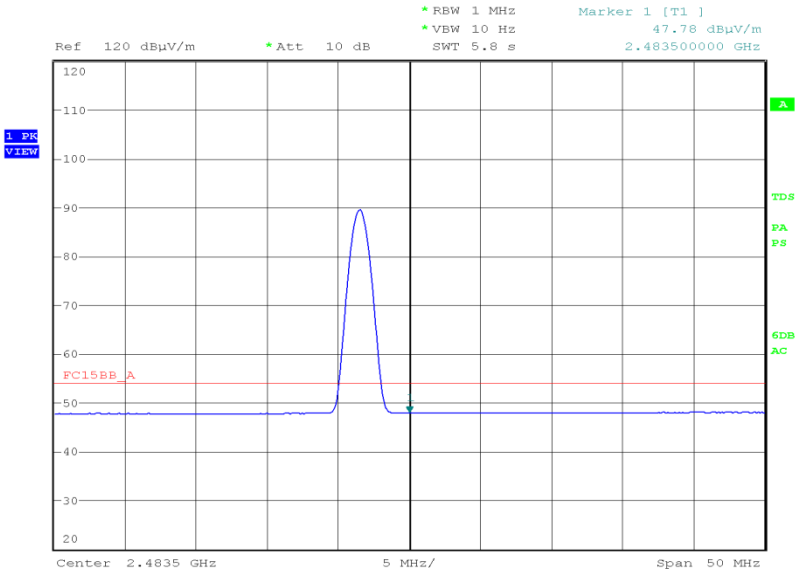
Final Peak



Date: 27.NOV.2014 10:38:19

Product Service

Final Average

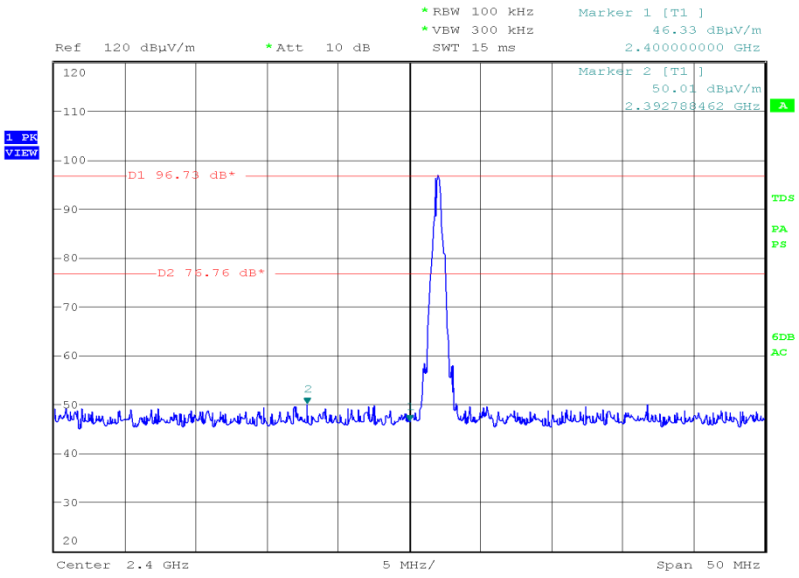


Date: 27.NOV.2014 10:39:22

Band Edge	
Frequency (MHz)	Final Peak (dBµV/m)
2400.00	50.01
2483.50	49.43

2400.00 MHz

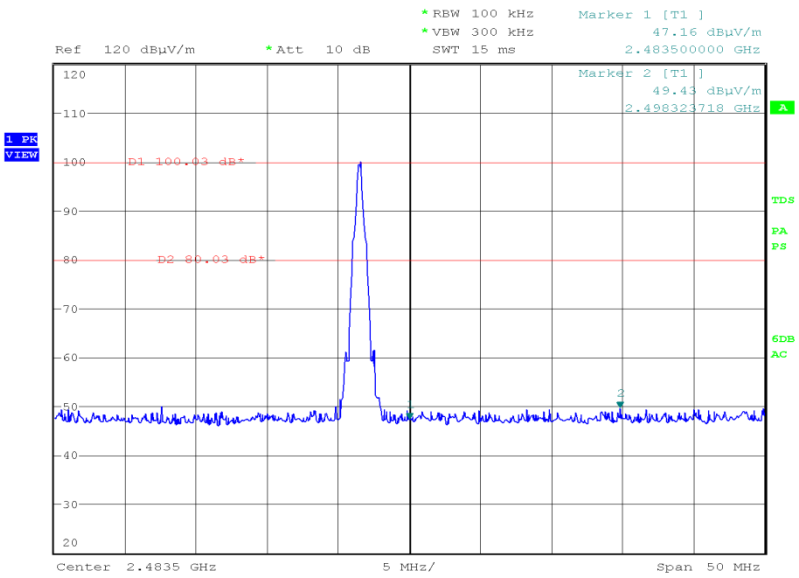
Final Peak



Product Service

2483.50 MHz

Final Peak



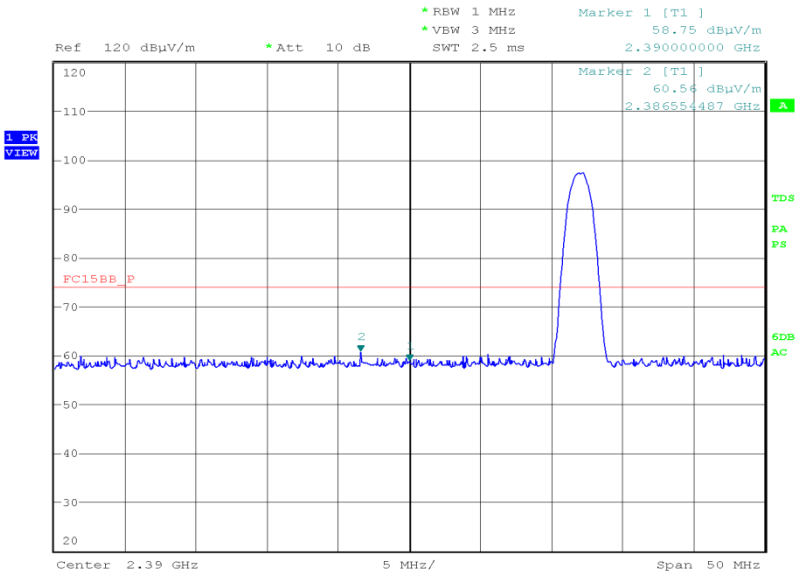
Date: 27.NOV.2014 10:35:43

Modulation/Packet Type: -

Restricted Bands of Operation		
Frequency (MHz)	Final Peak (dBµV/m)	Final Average (dBµV/m)
2390.00	60.56	47.84
2483.50	60.19	47.76

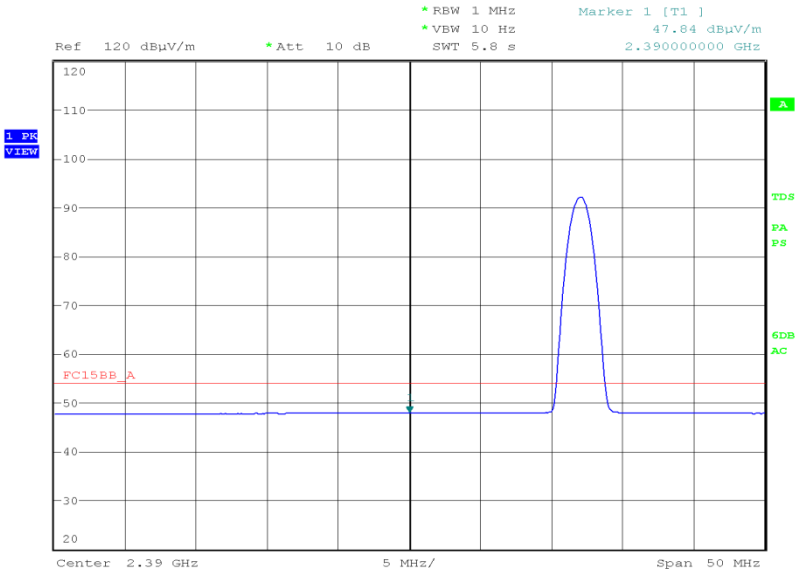
2390.00 MHz

Final Peak



Product Service

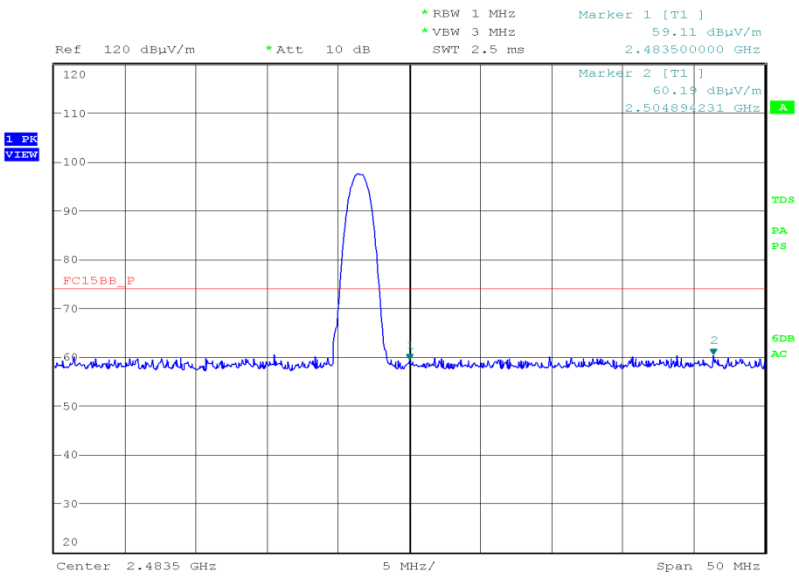
Final Average



Date: 2.DEC.2014 14:22:11

2483.50 MHz

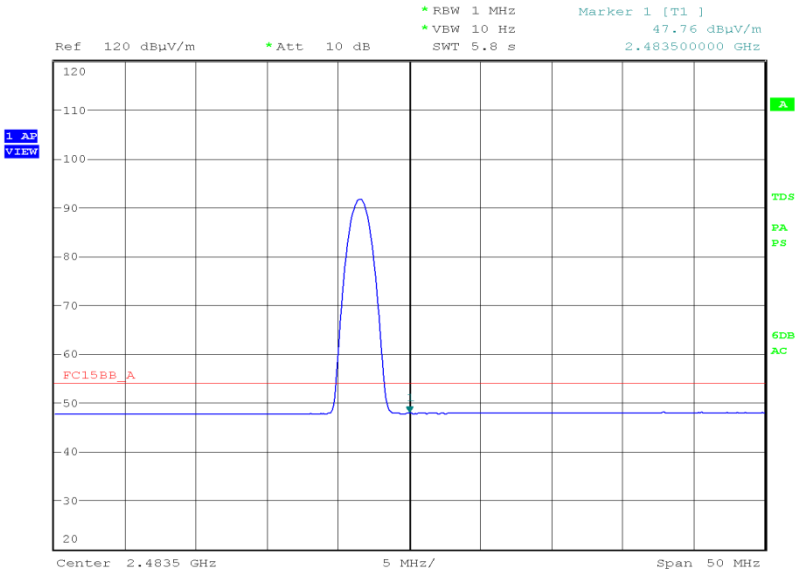
Final Peak



Date: 2.DEC.2014 10:25:14

Product Service

Final Average

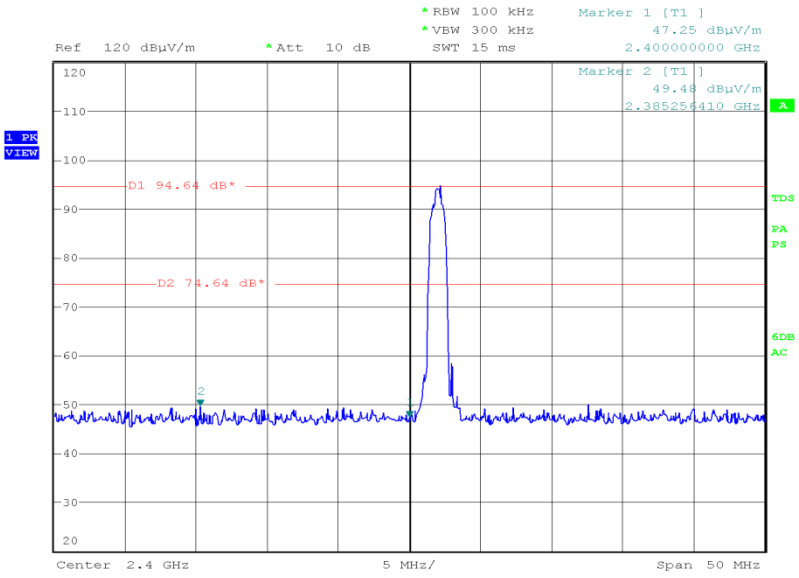


Date: 2.DEC.2014 10:23:55

Band Edge	
Frequency (MHz)	Final Peak (dBµV/m)
2400.00	49.48
2483.50	50.49

2400.00 MHz

Final Peak

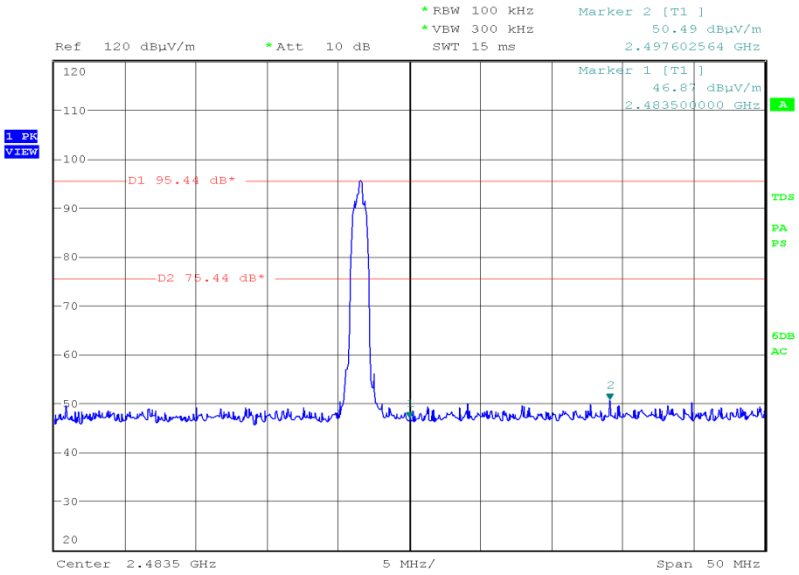


Date: 2.DEC.2014 10:16:38

Product Service

2483.50 MHz

Final Peak



Date: 2.DEC.2014 10:26:47

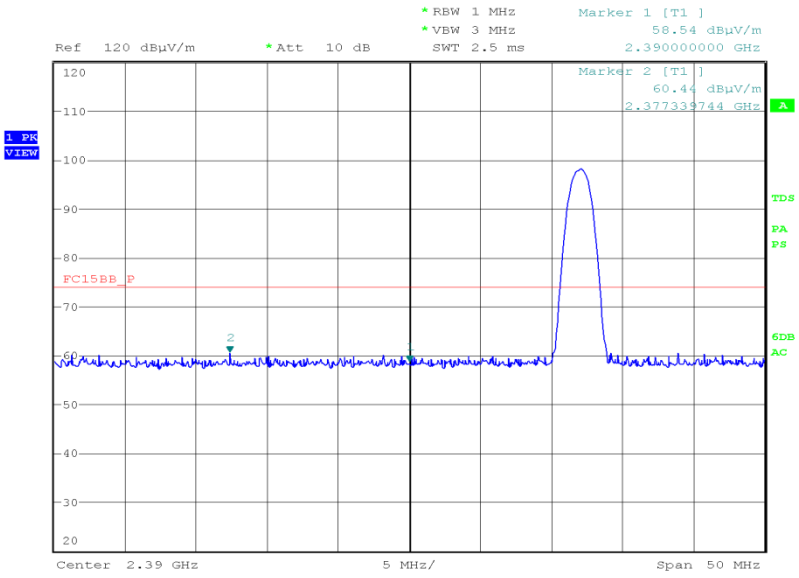
COMMERCIAL-IN-CONFIDENCE

Modulation/Packet Type: 8-DPSK/3DH5

Restricted Bands of Operation		
Frequency (MHz)	Final Peak (dBµV/m)	Final Average (dBµV/m)
2390.00	60.44	47.85
2483.50	61.41	47.80

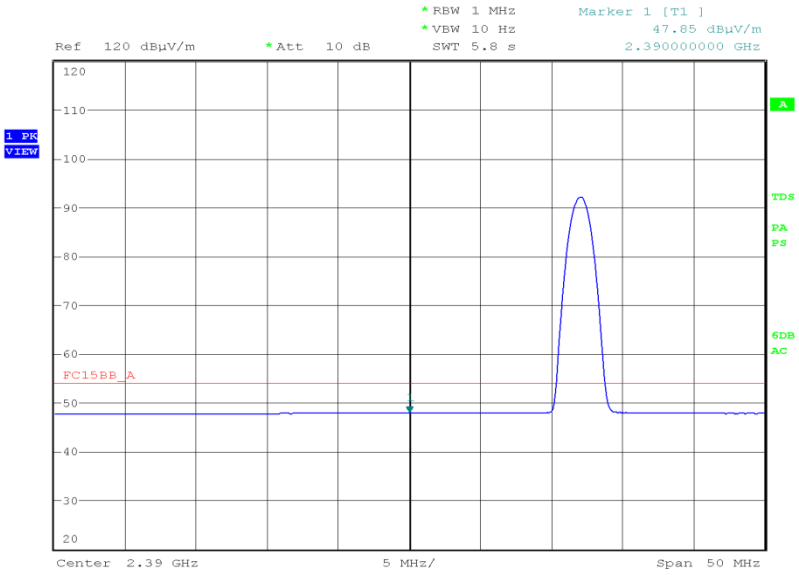
2390.00 MHz

Final Peak



Product Service

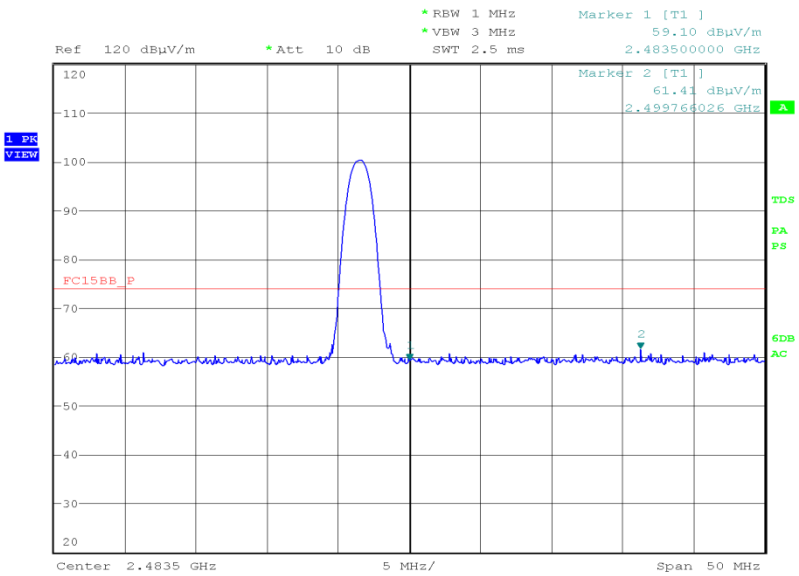
Final Average



Date: 2.DEC.2014 14:18:44

2483.50 MHz

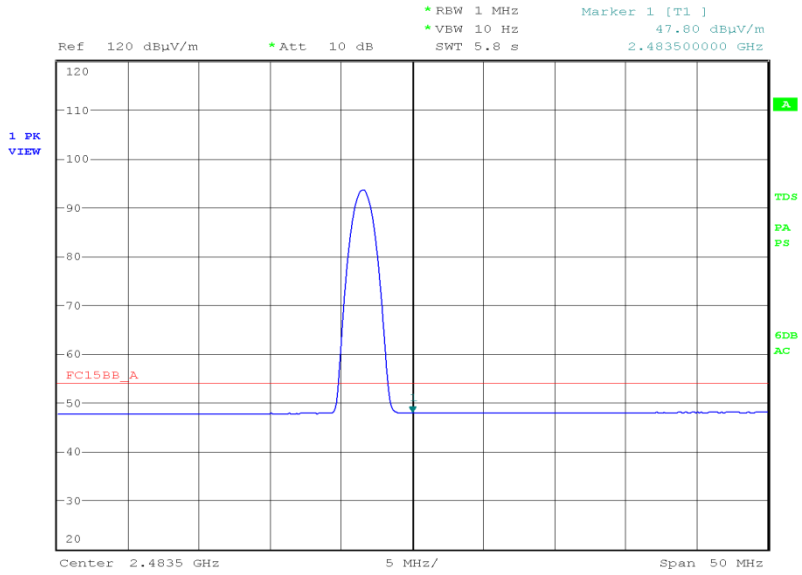
Final Peak



Date: 27.NOV.2014 11:05:24

Product Service

Final Average

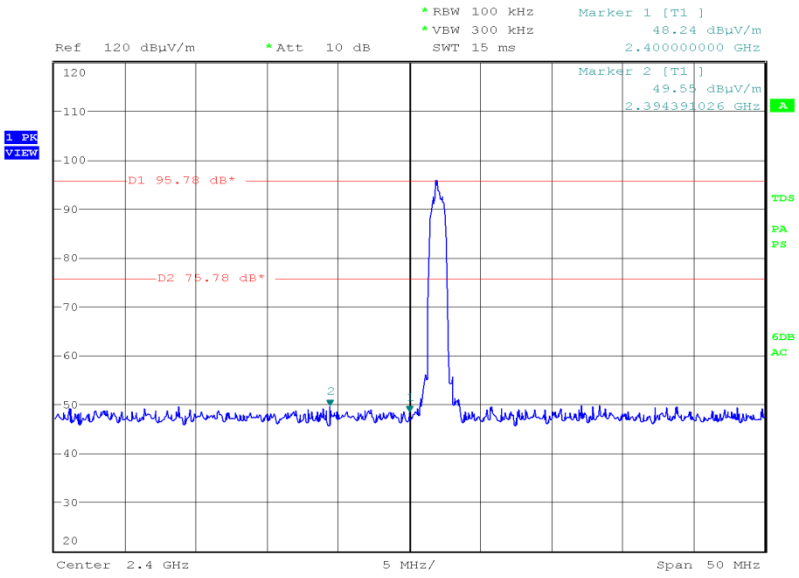


Date: 2.DEC.2014 14:16:15

Band Edge	
Frequency (MHz)	Final Peak (dBµV/m)
2400.00	49.55
2483.50	51.34

2400.00 MHz

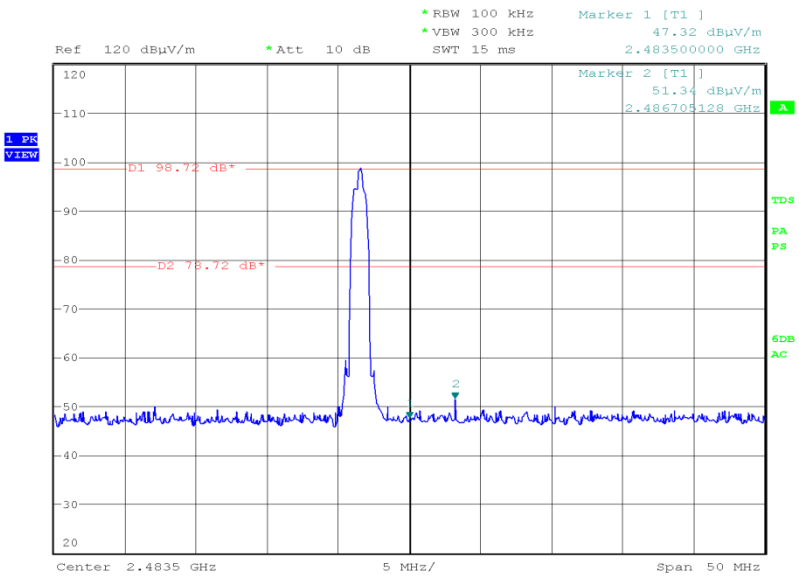
Final Peak



Date: 27.NOV.2014 11:17:40

2483.50 MHz

Final Peak



Date: 27.NOV.2014 11:03:27

Limit

Frequency (MHz)	Field Strength			Measurement Distance (m)
	(µV/m)	Average (dBµV/m)	Peak (dBµV/m)	
30-88	100	40.0	60.0	3
88-216	150	43.5	63.5	3
216-960	200	46.0	66.0	3
Above 960	500	54.0	74.0	3

Radiated Emissions which fall only in the restricted bands as defined in 15.205 must also comply with the limits in the table above. The table above does not apply for Radiated Emissions which fall outside the restricted bands as defined in 15.205. These emissions outside the restricted bands shall be at least 20 dB below the fundamental measured in a 100 kHz bandwidth using a peak detector. If the transmitted complies with the conducted power limits, based on the use of RMS averaging over a time interal, the attenuator required shall be 30 dB below the fundamental instead on 20 dB.

Product Service

SECTION 3

TEST EQUIPMENT USED

Product Service

3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.1 – AC Line Conducted Emissions					
Transient Limiter	Hewlett Packard	11947A	15	12	10-Dec-2014
3 phase LISN	Rohde & Schwarz	ESH2-Z5	323	12	16-Jan-2015
Screened Room (5)	Rainford	Rainford	1545	24	10-Jan-2015
Compliance 5 Emissions	Schaffner	C5e Software V.5.00.00	3275	-	N/A - Software
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	27-Oct-2015
Section 2.2 - Frequency Hopping Systems - 20dB Bandwidth and Channel Separation					
Power Supply Unit	Hewlett Packard	6282A	132	-	TU
Multimeter	Fluke	75 Mk3	455	12	23-Jul-2015
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	9-Jan-2015
Attenuator (10dB, 20W)	Lucas Weinschel	1	3225	12	12-Dec-2014
Section 2.3- Frequency Hopping Systems - Channel Dwell Time and Number of Hopping Channels					
Power Supply Unit	Hewlett Packard	6282A	132	-	TU
Multimeter	Fluke	75 Mk3	455	12	23-Jul-2015
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	9-Jan-2015
Attenuator (10dB, 20W)	Lucas Weinschel	1	3225	12	12-Dec-2014
Section 2.4 - Maximum Peak Conducted Output Power					
Power Supply Unit	Hewlett Packard	6282A	132	-	TU
Multimeter	Fluke	75 Mk3	455	12	23-Jul-2015
Attenuator (10dB, 20W)	Lucas Weinschel	1	3225	12	12-Dec-2014
P-Series Power Meter	Agilent Technologies	N1911A	3981	12	22-Sep-2015
50 MHz-18 GHz Wideband Power Sensor	Agilent Technologies	N1921A	3983	12	22-Sep-2015
Section 2.5 - EIRP Peak Power					
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	2-May-2015
Signal Generator (10MHz to 40GHz)	Rohde & Schwarz	SMR40	1002	12	19-Sep-2015
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Antenna (DRG Horn)	ETS-LINDGREN	3115	3125	12	16-Jul-2015
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	27-Oct-2015
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.6 - Spurious and Band Edge Emissions					
Antenna (Double Ridge Guide)	Link Microtek Ltd	AM180HA-K-TU2	230	24	26-Nov-2015
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	2-May-2015
Turntable Controller	Heinrich Diesel	HD 050	280	-	TU
Dual Power Supply Unit	Thurlby	PL320	288	-	TU
Signal Generator (10MHz to 40GHz)	Rohde & Schwarz	SMR40	1002	12	19-Sep-2015
Pre-Amplifier	Phase One	PSO4-0087	1534	12	1-Oct-2015
Screened Room (5)	Rainford	Rainford	1545	24	10-Jan-2015
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Filter (Hi Pass)	Lorch	9HP7-7000-SR	2833	12	4-Feb-2015
Antenna (Bilog)	Chase	CBL6143	2904	24	10-Jun-2015
Amplifier (8 - 18GHz)	Phase One	PS06-0061	3176	12	11-Aug-2015
Compliance 5 Emissions	Schaffner	C5e Software V.5.00.00	3275	-	N/A - Software
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	27-Oct-2015
'3.5mm' - '3.5mm' RF Cable (1m)	Rhophase	3PS-1803-1000-3PS	3697	12	28-Feb-2015
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
1GHz to 8GHz Low Noise Amplifier	Wright Technologies	APS04-0085	4365	12	1-Oct-2015
Suspended Subtrate Highpass Filter	Advance Power Components	11SH10-3000/X18000-O/O	4411	12	21-Mar-2015

TU – Traceability Unscheduled
O/P MON – Output Monitored with Calibrated Equipment

Product Service

3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:-

Test Discipline	MU
Frequency Hopping Systems - 20dB Bandwidth and Channel Separation	± 16.74 kHz
Frequency Hopping Systems - Channel Dwell Time and Number of Hopping Channels	-
EIRP Peak Power	30MHz to 1GHz: ± 5.1 dB 1GHz to 40GHz: ± 6.3 dB
Maximum Peak Conducted Output Power	± 0.70 dB
Spurious and Band Edge Emissions	Conducted: ± 3.08 dB Radiated: 30 MHz to 1 GHz: ± 5.1 dB Radiated: 1 GHz to 40 GHz: ± 6.3 dB
AC Line Conducted Emissions	± 3.2 dB

SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).