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Report On

FCC Testing of the Sharp SHT22 Dual-band CDMA (BC0, BC6), Tri-band LTE (B1, B11, B18). Dual mode Tablet PC with Bluetooth, WLAN, SRD(NFC) and GPS
In accordance with FCC CFR 47 Part 15C (Bluetooth)

COMMERCIAL-IN-CONFIDENCE

FCC ID: APYHRO00200

Document 75924762 Report 09 Issue 1 February 2014

Product Service

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COMMERCIAL-IN-CONFIDENCE

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FCC Testing of the Sharp SHT22 Dual-band CDMA (BC0, BC6), Tri-band LTE (B1, B11, B18). Dual mode Tablet PC with Bluetooth, WLAN, SRD(NFC) and GPS
In accordance with FCC CFR 47 Part 15C (Bluetooth)

Document 75924762 Report 09 Issue 1

February 2014

PREPARED FOR

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Authorised Signatory

DATED

03 February 2014

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);

G Lawler T Guy A Galpin

UKAS TESTING 0141

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SECTION 1

REPORT SUMMARY

FCC Testing of the
Sharp SHT22 Dual-band CDMA (BC0, BC6), Tri-band LTE (B1, B11, B18). Dual mode Tablet PC with Bluetooth, WLAN, SRD(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 verification of the FCC Testing of the Sharp SHT22 Dual-band CDMA (BC0, BC6), Tri-band LTE (B1, B11, B18). Dual mode Tablet PC with Bluetooth, WLAN, SRD(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
Model Number(s)	SHT22
Serial Number(s)	IMEI 004401115013407 IMEI 004401115013514
Number of Samples Tested	2
Test Specification/Issue/Date	FCC CFR 47 Part 15C (2012)
Incoming Release Date	Application Form 15 January 2014
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	9947 18 December 2013
Start of Test	16 January 2014
Finish of Test	21 January 2014
Name of Engineer(s)	G Lawler T Guy A Galpin
Related Document(s)	ANSI C63.10: 2009

Product Service

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	

Product Service

1.3 APPLICATION FORM

EQUIPMENT DESCRIPTION	
Model Name/Number	SHT22
Part Number	
FCC ID (if applicable)	APYHRO00200
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/B11/B18), Dual-band CDMA(BC0/BC6) Cellular Phone with Bluetooth, 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: 2402MHz～2480MHz
In case of Adaptive Frequency Hopping Equipment:	
	Maximum number of Hopping Frequencies: 2480MHz
	Minimum number of Hopping Frequencies: 2402MHz
Dwell Time:	
Minimum Channel Occupation Time:	
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: 260 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: 4 μs	
The value q as referred to in clause 4.3.2.5.2.2.2 is:	
☐	The equipment has implemented an non-LBT based DAA mechanism
☐	The equipment can operate in more than one adaptive mode

Product Service

In case of non-adaptive Equipment:		
The maximum RF Output Power (e.i.r.p.): 3.97 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:		
Power Spectral Density:		
Duty cycle, Tx-Sequence, Tx-gap:		
Dwell time, Minimum Frequency Occupation & Hopping Sequence (only for FHSS equipment):		
Hopping Frequency Separation (only for FHSS equipment):		
Medium Utilisation:		
Adaptivity & Receiver Blocking:		
Occupied Channel Bandwidth:		
Transmitter unwanted emissions in the OOB domain:		
Transmitter unwanted emissions in the spurious domain:		
Receiver spurious emissions:		
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	(e.g Bluetooth for EU)
Operating Frequency Range 2: 2412 MHz to 2472 MHz	(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: 2401 MHz to 2481 MHz	
Occupied Channel Bandwidth2: 2402 MHz to 2482 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: Dummy battery from external DC supply (4.0V)	
Describe the test modes available which can facilitate testing:	
Teraterm	
The equipment type (e.g. Bluetooth®, IEEE 802.11™ [i.3], proprietary, etc.):	
Bluetooth, 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.	

Product Service

	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:

Name: Hiroyuki Murakami

Position held: Supervisor

Date: 15th January 2014

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Sharp SHT22 Dual-band CDMA (BC0, BC6), Tri-band LTE (B1, B11, B18). Dual mode Tablet PC with Bluetooth, WLAN, SRD(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 for lab tests and a fully charged internal battery for radiated tests.

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 0 - No modifications were made to the test sample during testing.

Product Service

SECTION 2

TEST DETAILS

FCC Testing of the
Sharp SHT22 Dual-band CDMA (BC0, BC6), Tri-band LTE (B1, B11, B18). Dual mode Tablet PC with Bluetooth, WLAN, SRD(NFC) and GPS
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

SHT22 S/N: IMEI 004401115013407 - Modification State 0

2.1.3 Date of Test

21 January 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

The EUT was set up on a test table 800mm above a horizontal ground plane. A vertical ground plane was also required and is placed 400mm from the EUT.

The EUT was powered through a Line Impedance Stabilisation Network (LISN) which was bonded to the ground plane. The EUT was located so that the distance between the EUT and the LISN was no less than 800mm. The cable between the mains input of the EUT and the LISN was 1m.

A preliminary profile of the Conducted Emissions is obtained over the frequency range 150kHz to 30MHz. Any points of interest were noted for formal measurements.

During formal measurements, the measuring receiver is tuned to the emission of interest where Quasi – Peak and Average measurements were performed in a 9kHz Video and Resolution Bandwidth.

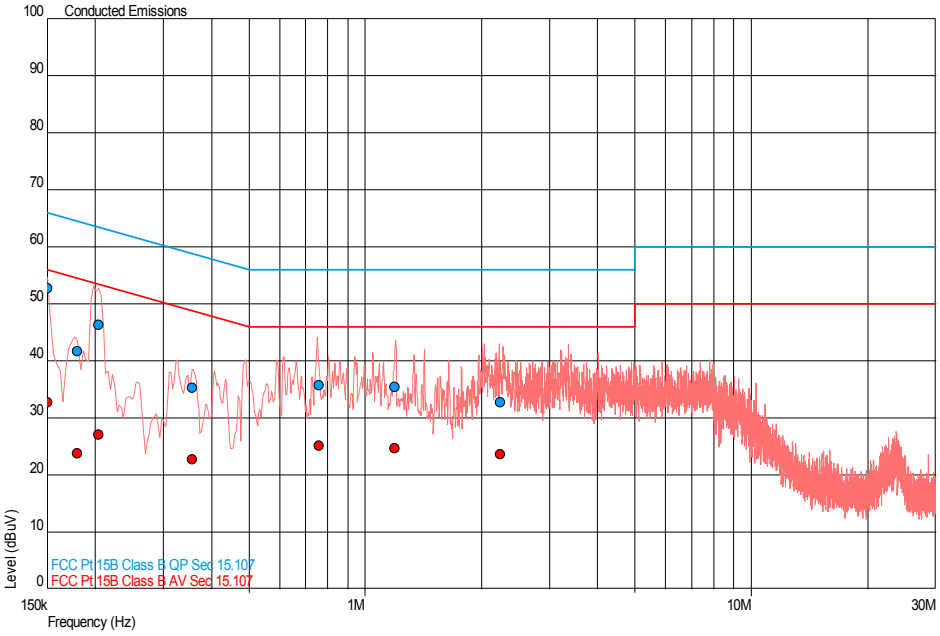
2.1.6 Environmental Conditions

Ambient Temperature	22.9°C
Relative Humidity	26.0%

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 (dBµV)	AV Margin (dBµV)
0.150	52.8	66.0	-13.2	32.8	56.0	-23.2
0.180	41.8	64.5	-22.7	23.8	54.5	-30.7
0.204	46.3	63.5	-17.1	27.1	53.5	-26.3
0.357	35.3	58.8	-23.5	22.8	48.8	-26.0
0.760	35.7	56.0	-20.3	25.1	46.0	-20.9
1.193	35.5	56.0	-20.5	24.7	46.0	-21.3
2.232	32.8	56.0	-23.2	23.6	46.0	-22.4

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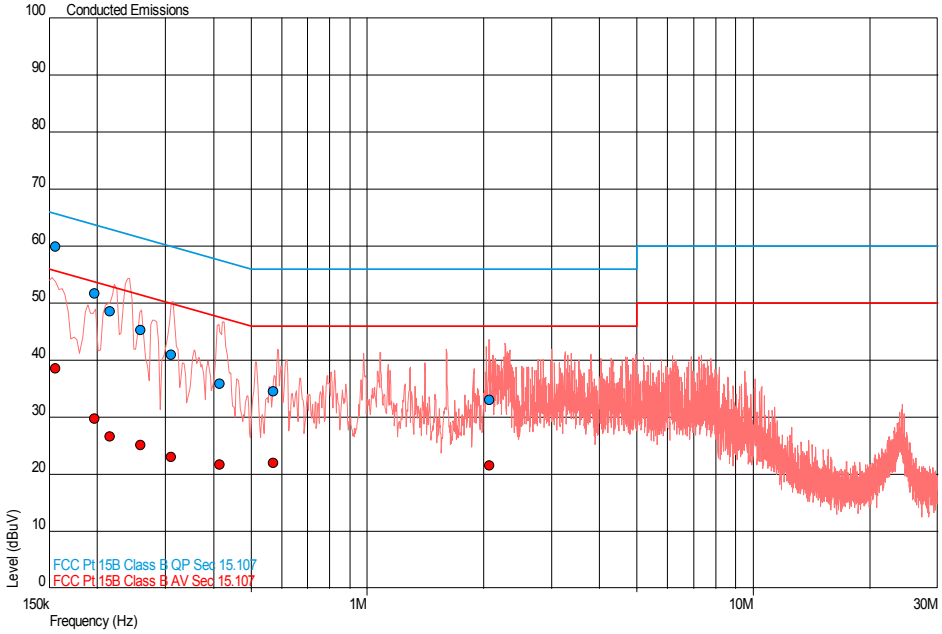
Neutral Line



Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dBµV)	AV Level (dBµV)	AV Limit (dBµV)	AV Margin (dBµV)
0.155	59.9	65.7	-5.8	38.5	55.7	-17.2
0.197	51.7	63.7	-12.0	29.7	53.7	-24.0
0.215	48.6	63.0	-14.4	26.7	53.0	-26.3
0.259	45.2	61.5	-16.2	25.2	51.5	-26.3
0.310	41.0	60.0	-19.0	23.1	50.0	-26.8
0.415	35.9	57.5	-21.7	21.7	47.5	-25.8
0.573	34.6	56.0	-21.4	22.0	46.0	-24.0
2.069	33.1	56.0	-22.9	21.6	46.0	-24.4

2.2 FREQUENCY HOPPING SYSTEMS - 20dB 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

SHT22 S/N: IMEI 004401115013514 - Modification State 0

2.2.3 Date of Test

17 January 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 EUT was transmitted at maximum power via a cable to the Spectrum Analyser. The Analyser settings were adjusted to display the resultant trace on screen. The peak point of the trace was measured and the markers positioned to give the -20dBc points of the displayed spectrum.

The EUT was transmitted at maximum power into a Spectrum Analyser. 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.

2.2.6 Environmental Conditions

Ambient Temperature	24.2°C
Relative Humidity	33.7%

Product Service

2.2.7 Test Results

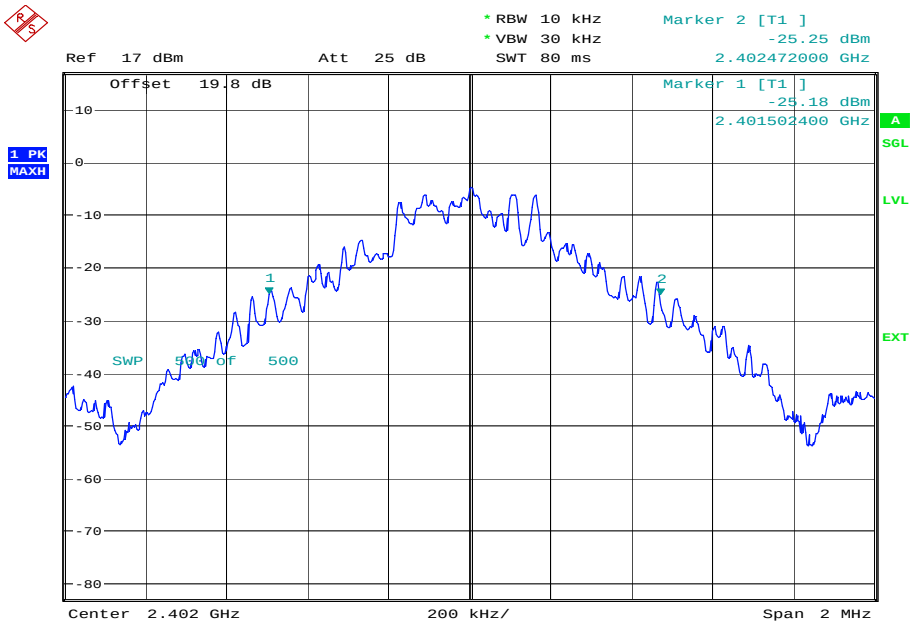
4.0 V DC Supply

20dB Bandwidth

2402 MHz

Data Rate (Mbps)	20dB Bandwidth (kHz)
DH1	969.6
DH3	931.2
DH5	886.4

DH1



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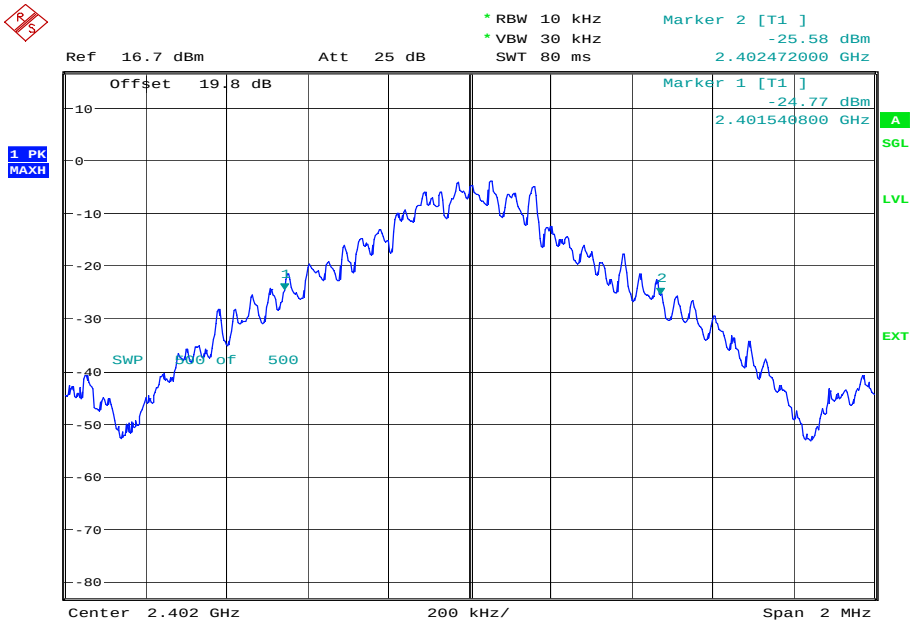
Product Service

DH3



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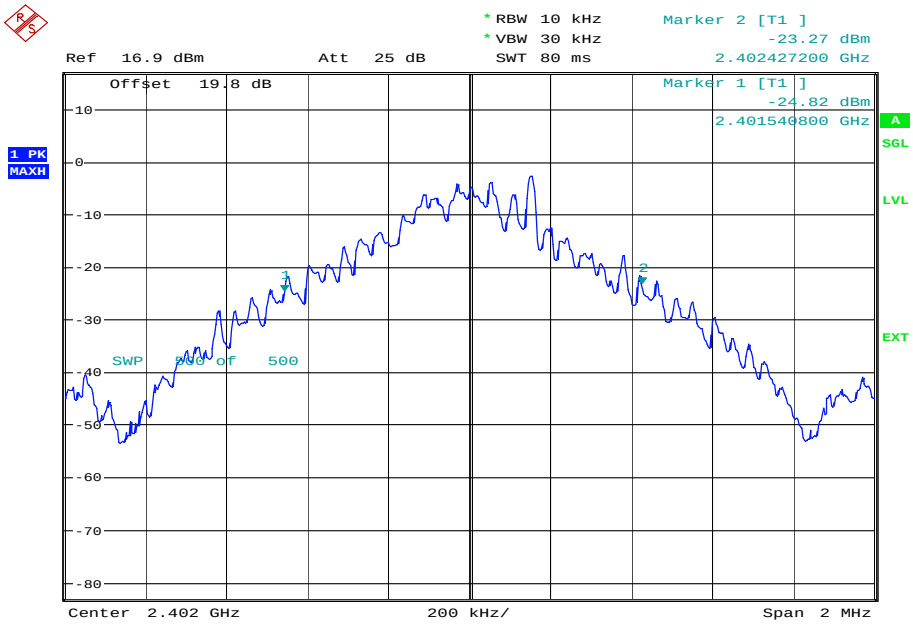
DH5



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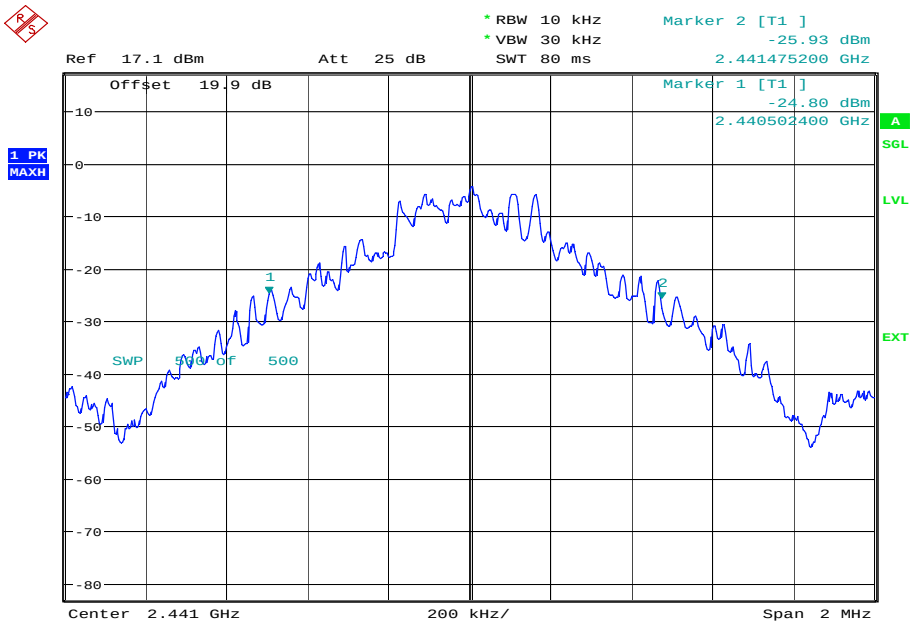
Product Service

2441 MHz

Data Rate (Mbps)	20dB Bandwidth (kHz)
DH1	972.8
DH3	931.2
DH5	883.2

DH1



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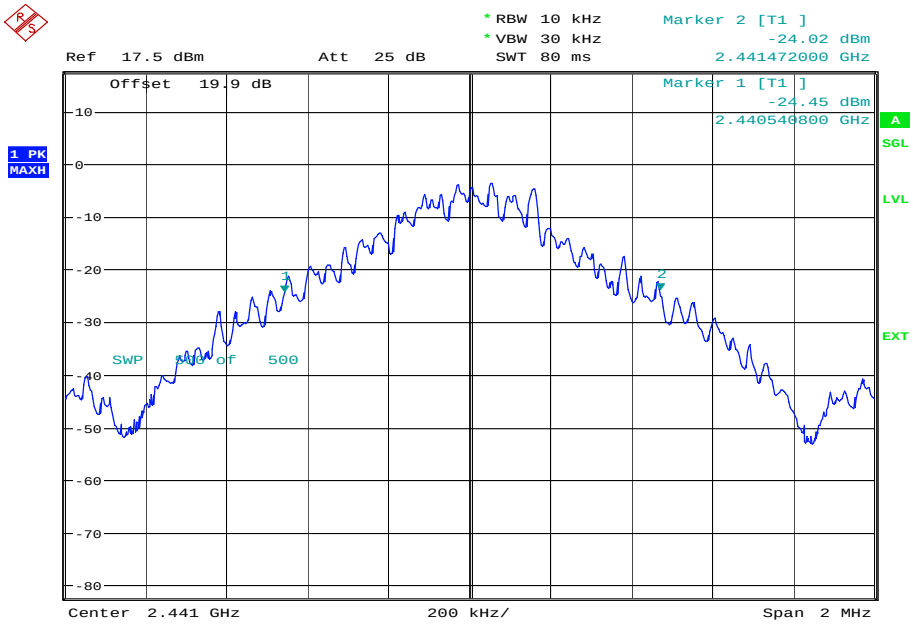
Product Service

DH3



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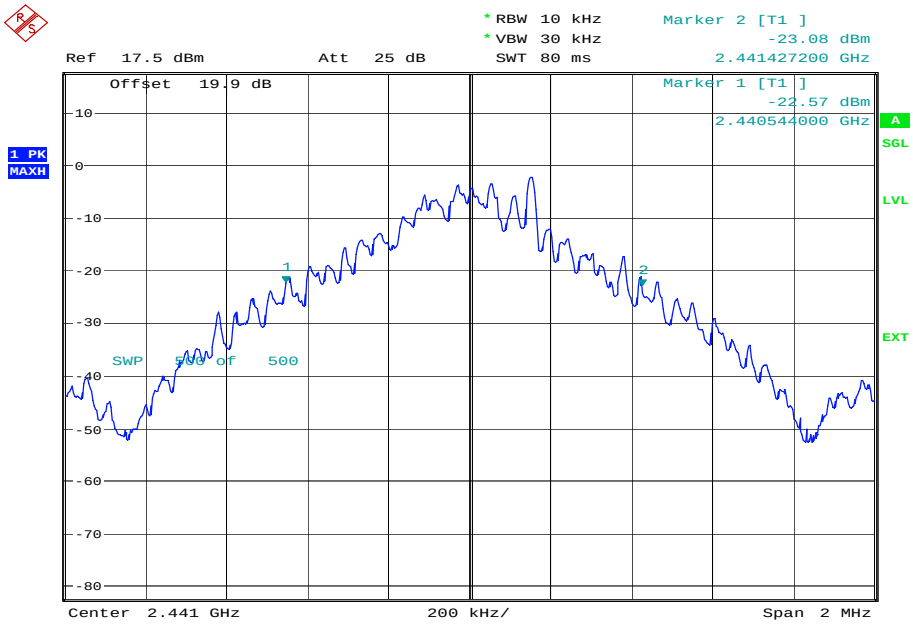
DH5



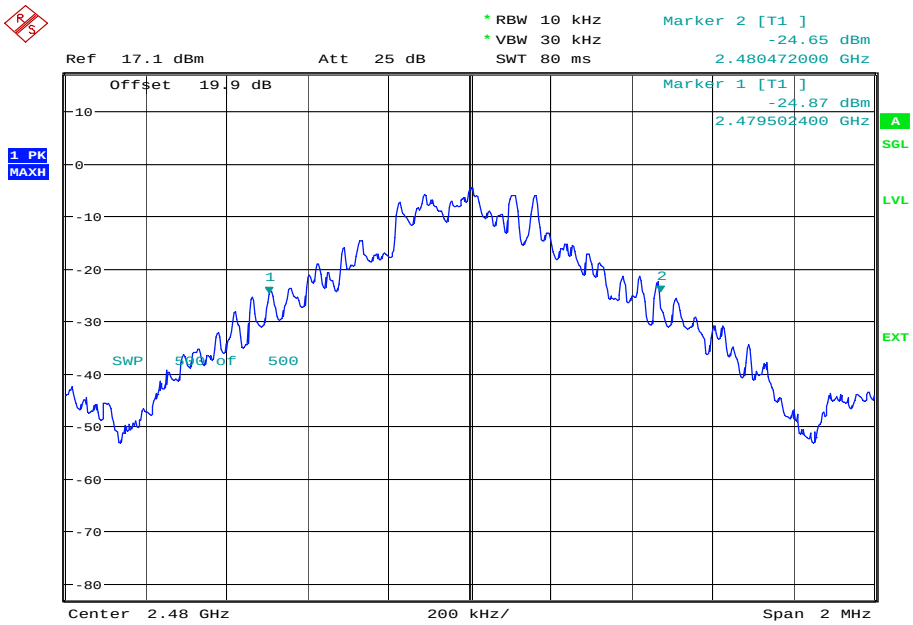
Date: 20.JAN.2014 16:00:36

Product Service

2480 MHz

Data Rate (Mbps)	20dB Bandwidth (kHz)
DH1	969.6
DH3	931.2
DH5	886.4

DH1



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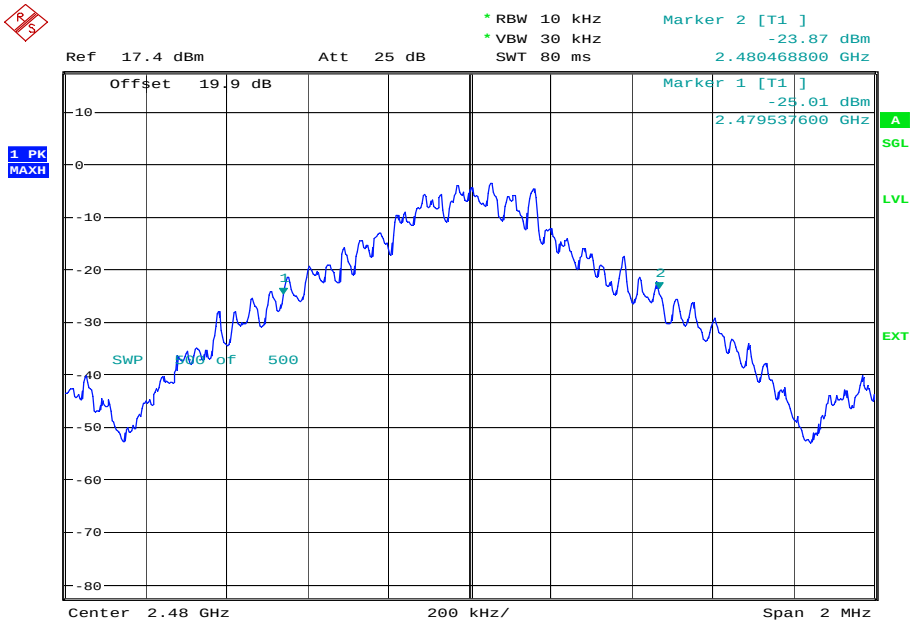
Product Service

DH3



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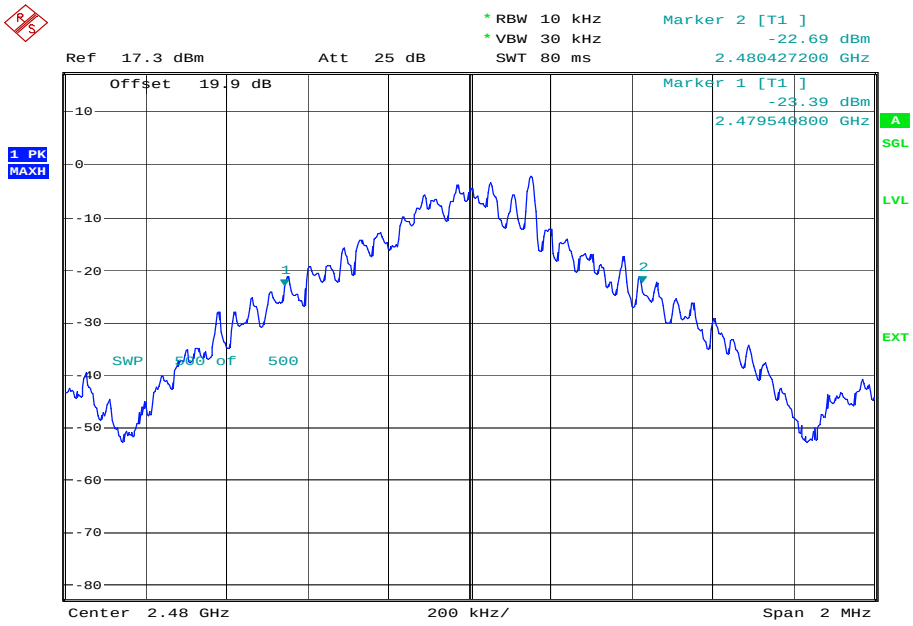
DH5



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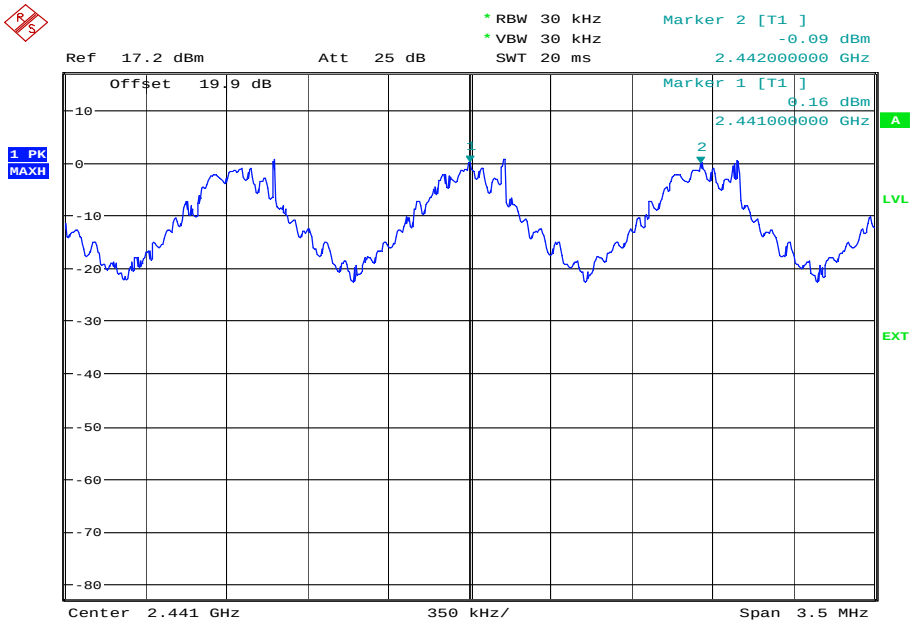
Limit Clause

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

Product Service

Channel Separation

Channel Separation: 1 MHz



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.

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

SHT22 S/N: IMEI 004401115013514 - Modification State 0

2.3.3 Date of Test

20 January 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

DH1

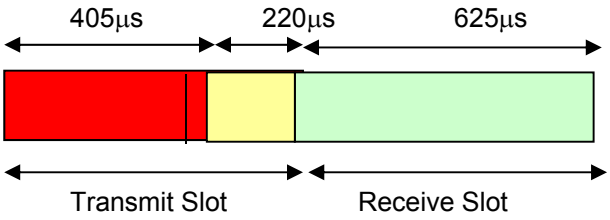
The Bluetooth system hops at a rate of 1600 times per second. Thus, this equates to 1600 timeslots in 1 second.

The DH1 data rate operates on a Transmit on 1 timeslot and Receive on 1 timeslot basis. Thus, in 1 second, there are 800 Transmit timeslots and 800 Receive timeslots.

Thus:

$$1 \text{ Timeslot} = \frac{1}{1600} = 625\mu s$$

In 1 transmit timeslot, the transmit on time is only 405µs. 220µs is reserved as off time for the synthesizer to re-tune ready for the next transmit frequency. The following timeslot is a receive slot. This process continues assuming the data rate remains the same.



Product Service

DH1 Timeslot Arrangement Showing One Complete Transmit and Receive Cycle

So, with 800 Tx and 800 Rx timelsots, the transmitter is on for 800 x 405µs = 0.324 seconds.

$$\therefore \quad \frac{\text{Total Tx Time On}}{\text{No of Channels}} = \frac{0.324}{80} = 4.05\text{ms}$$

So, in 32 seconds, the transmitter dwell time per channel is:

32 x 4.05ms = 0.1296 seconds

DH3

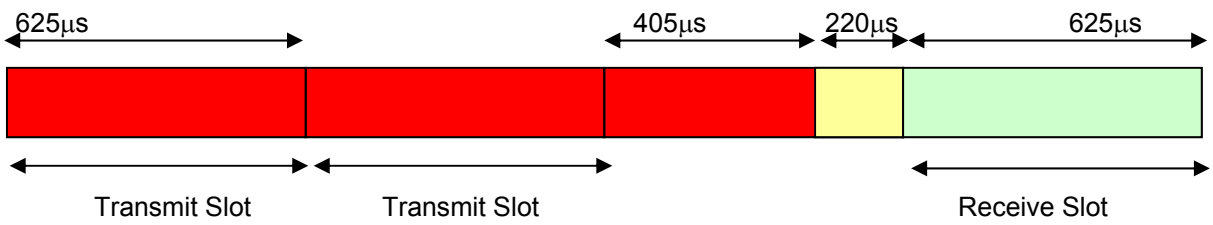
With data rate DH3, the data payload is higher and can use up to 3 timeslots. When more than one timeslot is used, the frequency does not hop and transmission is continuous on all 3 slots, (ie. no receive slot in-between the 3 transmit slots). The 220µs off time for synthesizer re-tuning at the end of a slot is only used on the final slot. Thus, for one cycle, there are 3 transmit timeslots. 2 are 625µs long and the final slot is transmitting for 405µs.

The DH3 data rate operates on a Transmit on 3 timeslots and Receives on 1 timeslot basis, (assuming maximum data payload). The frequency-hopping rate is the same. Thus, in 1 second, there are 1200 Transmit timeslots and 400 Receive timeslots.

Thus:

$$1\text{ Timeslot} = \frac{1}{1600} = 625\mu\text{s}$$

The first 2 Transmit timeslots are transmitting for the complete 625µs. In the third transmit slot, the transmit on time is only 405µs. 220µs is reserved as off time for the synthesizer to re-tune ready for the next transmit frequency. The following timeslot is a receive slot. This process continues assuming the data rate remains the same.



Product Service

DH3 Timeslot Arrangement Showing One Complete Transmit and Receive Cycle, (Maximum Payload)

Thus, the transmitter for one complete transmit and receive cycle would be on for:

Tx (2 x 625µs) + (1 x 405µs) = 1.655ms

So:

800 x 625µs = 0.5 seconds
400 x 405µs = 0.162 seconds

Thus: 0.5 + 0.162 = 0.662 seconds

$$\therefore \quad \frac{\text{Total Tx Time On}}{\text{No Of Channels}} = \frac{0.662}{80} = 8.275\text{ms}$$

So, in 32 seconds, the transmitter dwell time per channel is:

32 x 8.275ms = 0.2648 seconds

DH5

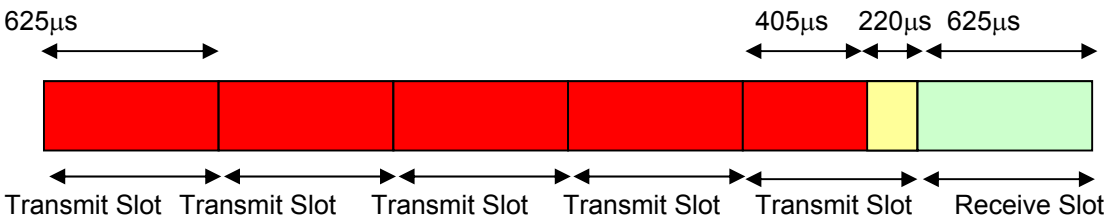
With data rate DH5, the data payload is higher and can use up to 5 timeslots. When more than one timeslot is used, the frequency does not hop and transmission is continuous on all 5 slots, (ie. no receive slot in-between the 5 transmit slots). The 220µs off time for synthesizer re-tuning at the end of a slot is only used on the final slot. Thus, for one cycle, there are 5 transmit timeslots. 4 are 625µs long and the final slot is transmitting for 405µs.

The DH5 data rate operates on a Transmit on 5 timeslots and Receives on 1 timeslot basis, (assuming maximum data payload). The frequency-hopping rate is the same. Thus, in 1 second, there are 1333.3 Transmit timeslots and 266.7 Receive timeslots.

Thus:

$$1\text{ Timeslot} = \frac{1}{1600} = 625\mu\text{s}$$

The first 4 Transmit timeslots are transmitting for the complete 625µs. In the fifth transmit slot, the transmit on time is only 405µs. 220µs is reserved as off time for the synthesizer to re-tune ready for the next transmit frequency. The following timeslot is a receive slot. This process continues assuming the data rate remains the same.



Product Service

DH5 Timeslot Arrangement Showing One Complete Transmit and Receive Cycle, (Maximum Payload)

Thus, the transmitter for one complete transmit and receive cycle would be on for:

Tx (2 x 625μs) + (1 x 405μs) = 2.905ms

So:

1066.7 x 625μs = 0.666 seconds
266.7 x 405μs = 0.108 seconds

Thus: 0.666 + 0.108 = 0.774 seconds

$$\therefore \quad \frac{\text{Total Tx Time On}}{\text{No Of Channels}} = \frac{0.774}{80} = 9.675\text{ms}$$

So, in 32 seconds, the transmitter dwell time per channel is:

32 x 9.675ms = 0.31 seconds

2.3.6 Environmental Conditions

Ambient Temperature	20.7°C
Relative Humidity	33.1%

Product Service

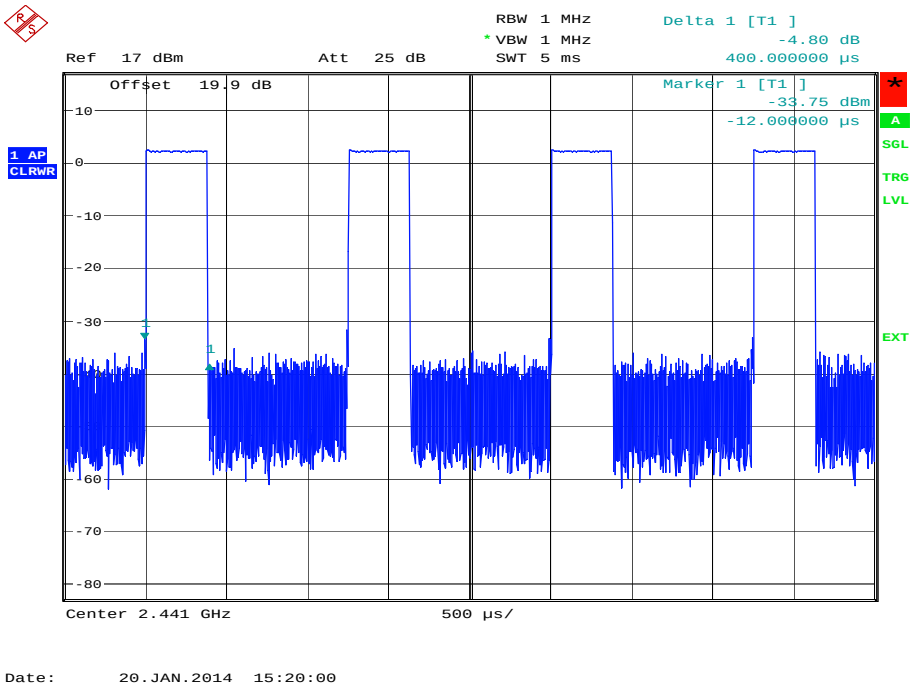
2.3.7 Test Results

4.0 V DC Supply

Channel Dwell Time

DH1

0.4 ms

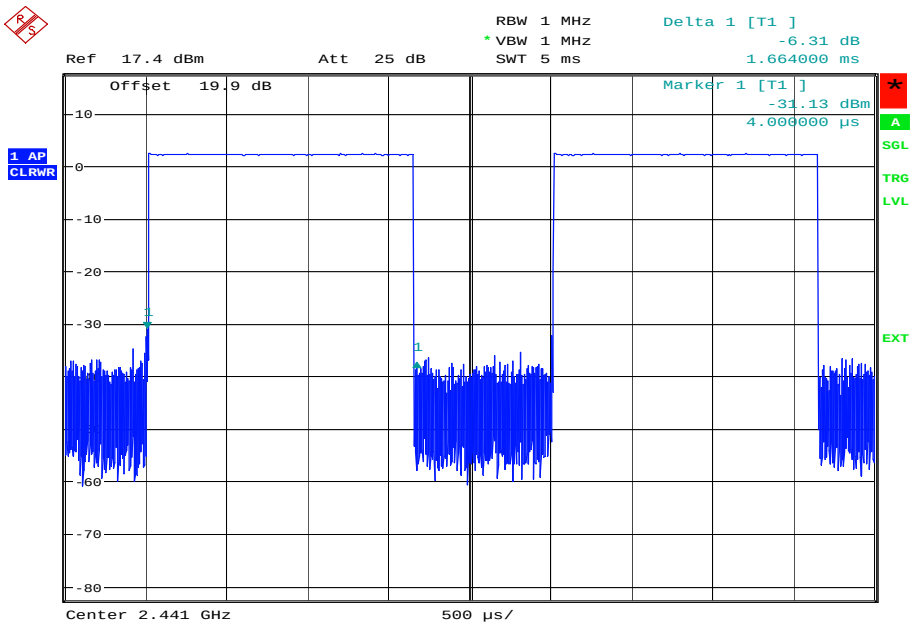


Date: 20.JAN.2014 15:20:00

Product Service

DH3

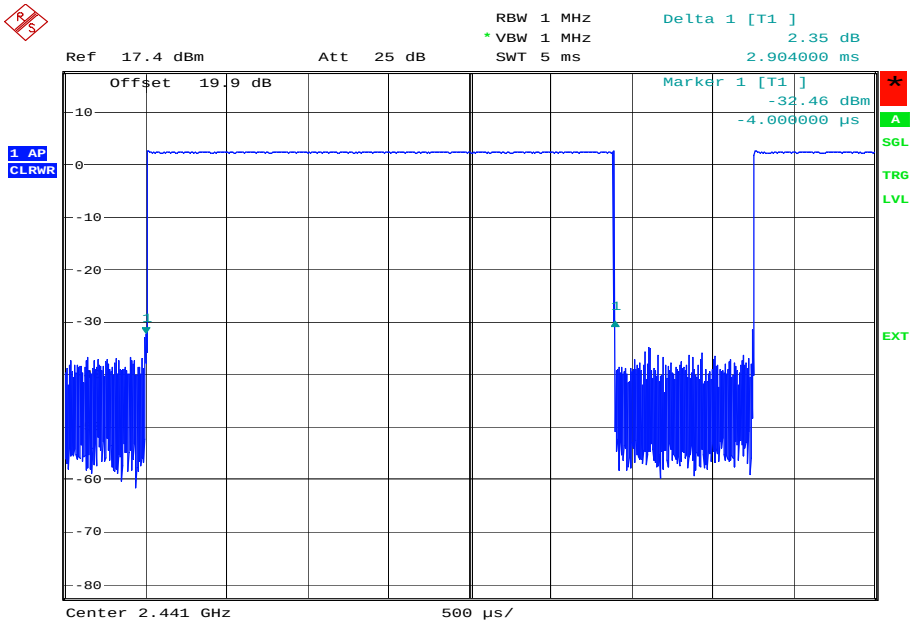
1.664 ms



Date: 20.JAN.2014 14:50:52

DH5

2.904 ms



Date: 20.JAN.2014 15:55:41

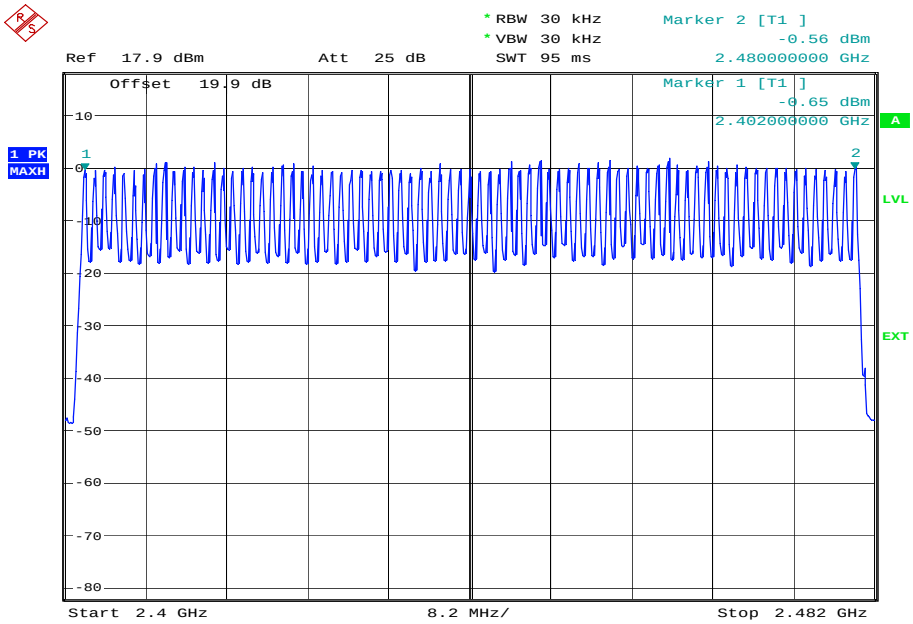
Product Service

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.

Number of Hopping Channels

79



Date: 20.JAN.2014 16:07:23

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

SHT22 S/N: IMEI 004401115013514 - Modification State 0

2.4.3 Date of Test

20 January 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 EUT was connected to a Peak Power Meter via a cable and attenuator. The path loss between the EUT and sensor was measured and entered as an offset. Measurements were made on the bottom, middle and top channels on all supported data rates.

2.4.6 Environmental Conditions

Ambient Temperature	20.7°C
Relative Humidity	33.1%

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	0.71	1.18	1.00	1.177	1.311	1.260
DH3	0.78	1.31	1.09	1.196	1.353	1.284
DH5	0.77	1.23	0.95	1.193	1.327	1.246

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

SHT22 S/N: IMEI 004401115013407 - Modification State 0

2.5.3 Date of Test

17 January 2014 & 18 January 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

The EUT was transmitted at maximum power via a cable to the Spectrum Analyser. The Analyser settings were adjusted to display the resultant trace on screen and a resolution bandwidth and video bandwidth of 1 MHz were used to perform the measurement. The level on the spectrum analyser 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. A peak power analyser was also used to obtain a correction factor for the wideband signal.

A calculation was then performed to obtain the final figure.

2.5.6 Environmental Conditions

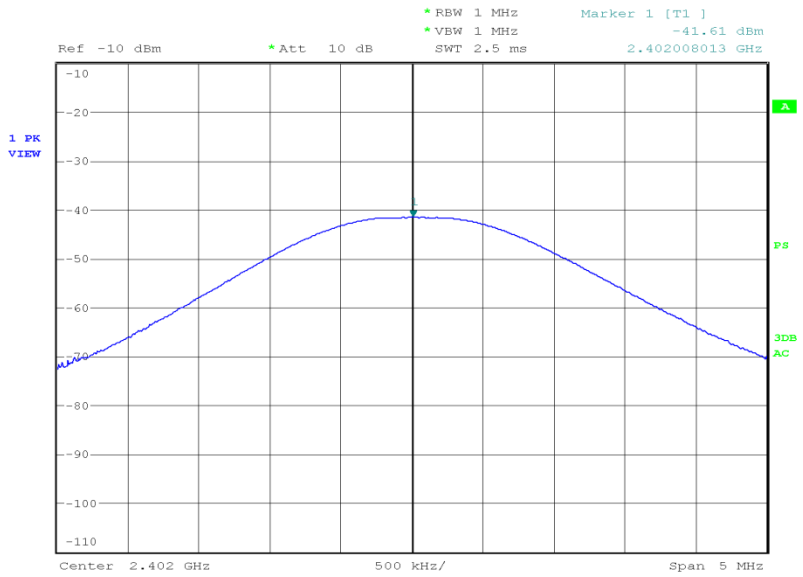
Ambient Temperature	21.0°C
Relative Humidity	35.0%

Product Service

2.5.7 Test Results

2402 MHz

EIRP (dBm)	EIRP (mW)
0.46	1.111

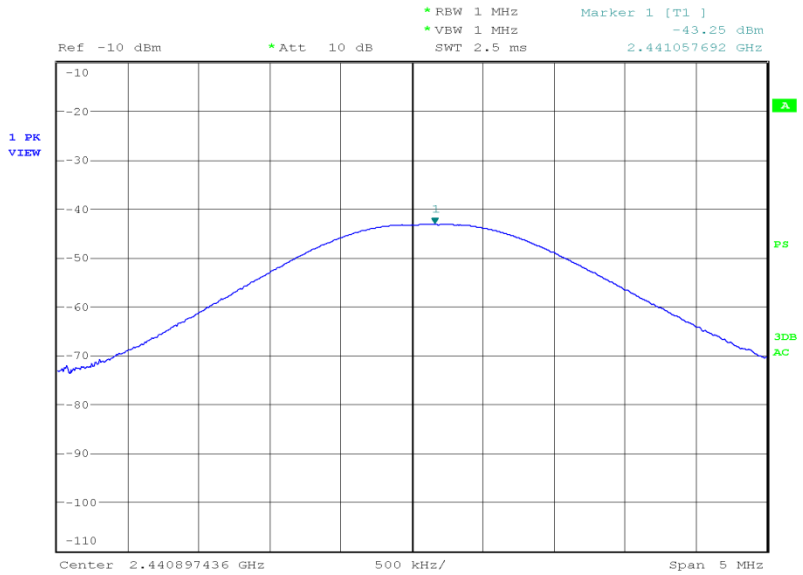


Date: 17.JAN.2014 04:26:28

Product Service

2441 MHz

EIRP (dBm)	EIRP (mW)
-0.23	0.948

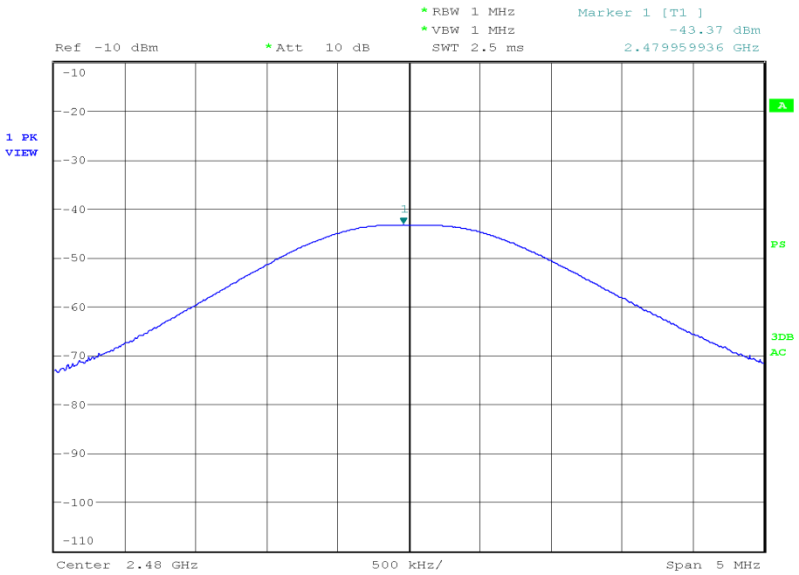


Date: 17.JAN.2014 03:59:38

Product Service

2480 MHz

EIRP (dBm)	EIRP (mW)
-0.56	0.879



Date: 17.JAN.2014 04:22:41

Limit

EIRP (dBm)	EIRP (mW)
36.0	4000

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

SHT22 S/N: IMEI 004401115013514 - Modification State 0

2.6.3 Date of Test

16 January 2014, 17 January 2014 & 19 January 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

For conducted emissions, the EUT was set to operate at maximum power on the worst case data rate. The test was performed on the bottom, middle and top channels. The test was performed from 9 kHz to 25 GHz. Firstly, the power of each fundamental frequency was measured in 100 kHz bandwidth and this was used to show a -20 dBc limit line on the trace. The measurement path loss in each relevant frequency band was measured and entered a s a reference level offset.

For radiated emissions, the test method described above was also used. However, the measurement was performed from 30 MHz to 25 GHz and the path loss is incorporated as a transducer factor and entered into the spectrum analyser.

The band edge measurements were performed in accordance with ANSI C63.10, Clause 6.9.2. The results were analysed to ensure compliance with restricted bands. The EUT was set to the lowest and highest operating frequencies.

2.6.6 Environmental Conditions

Ambient Temperature	20.0 - 24.8°C
Relative Humidity	33.0 - 37.0%

Product Service

2.6.7 Test Results

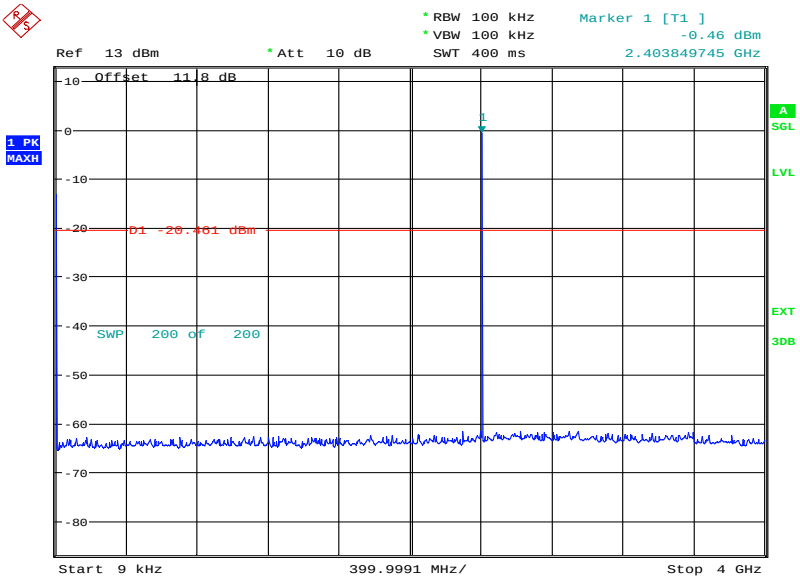
4.0 V DC Supply

Spurious Conducted Emissions

DH5

2402 MHz

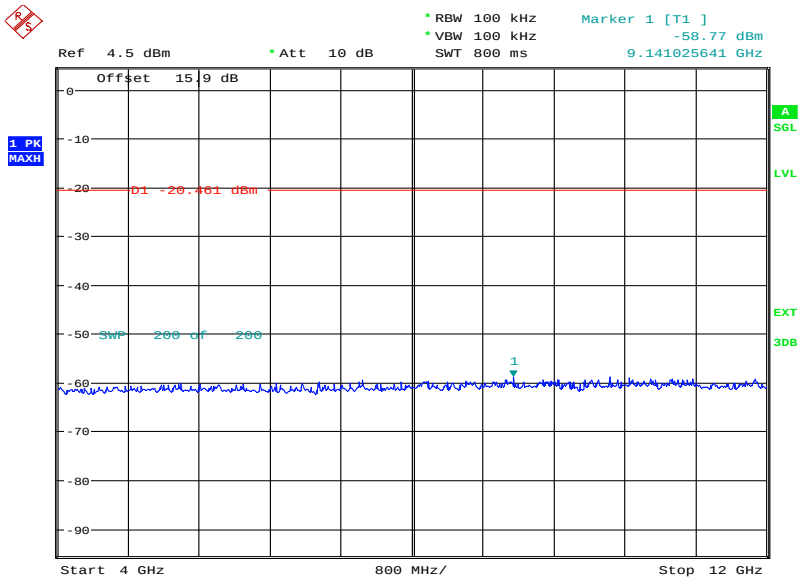
9 kHz to 4 GHz



Date: 16.JAN.2014 13:37:06

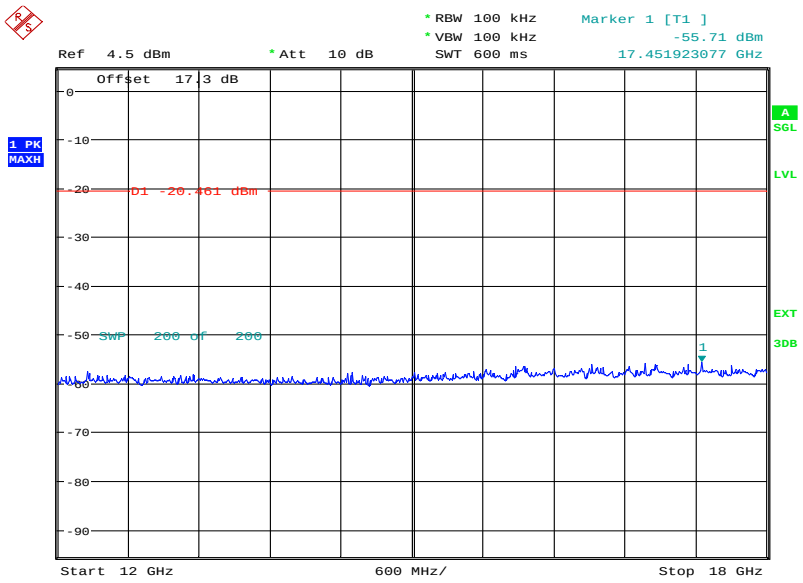
Product Service

4 GHz to 12 GHz



Date: 16.JAN.2014 14:08:22

12 GHz to 18 GHz



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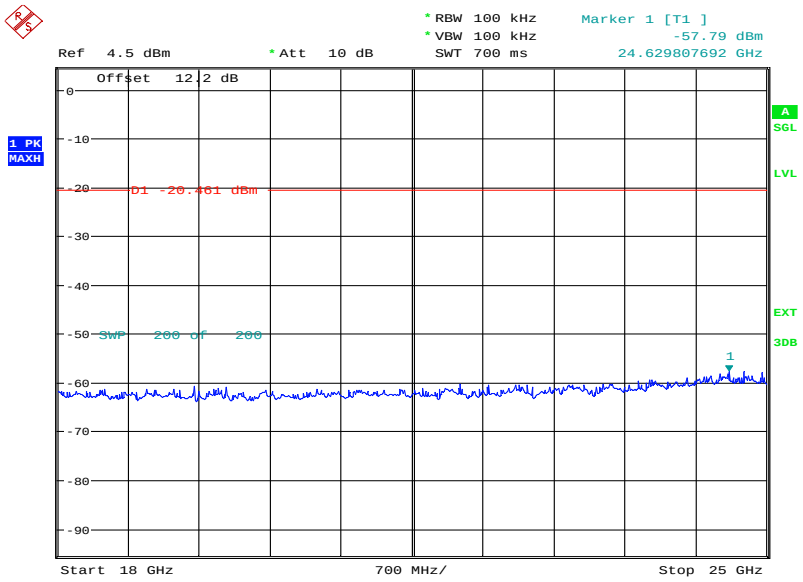
Product Service

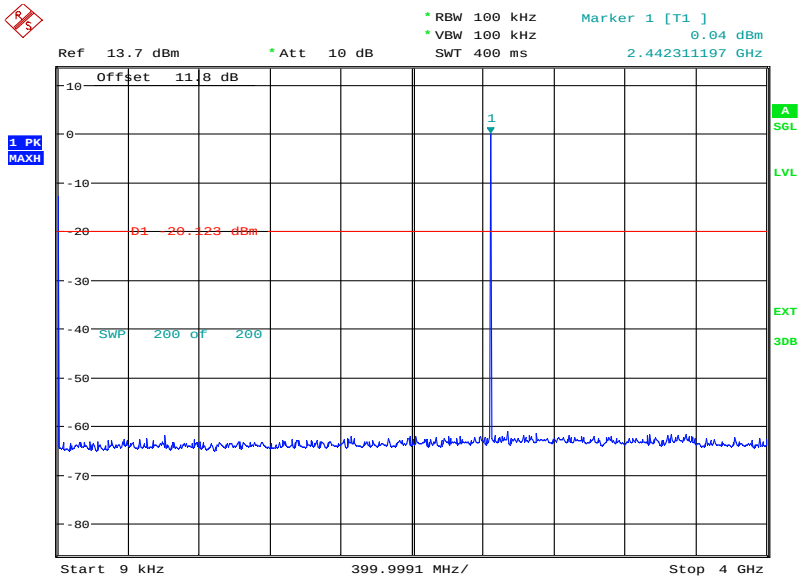
18 GHz to 25 GHz



Date: 17.JAN.2014 08:32:56

2441 MHz

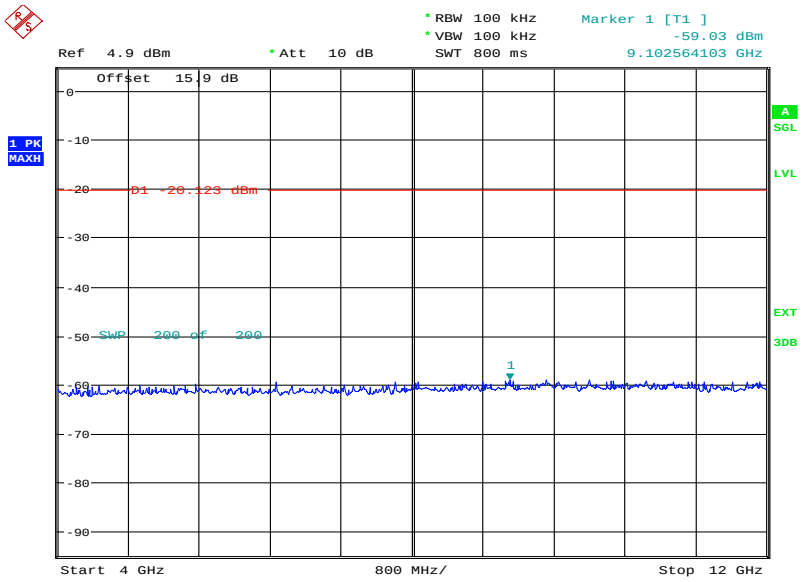
9 kHz to 4 GHz



Date: 16.JAN.2014 13:43:49

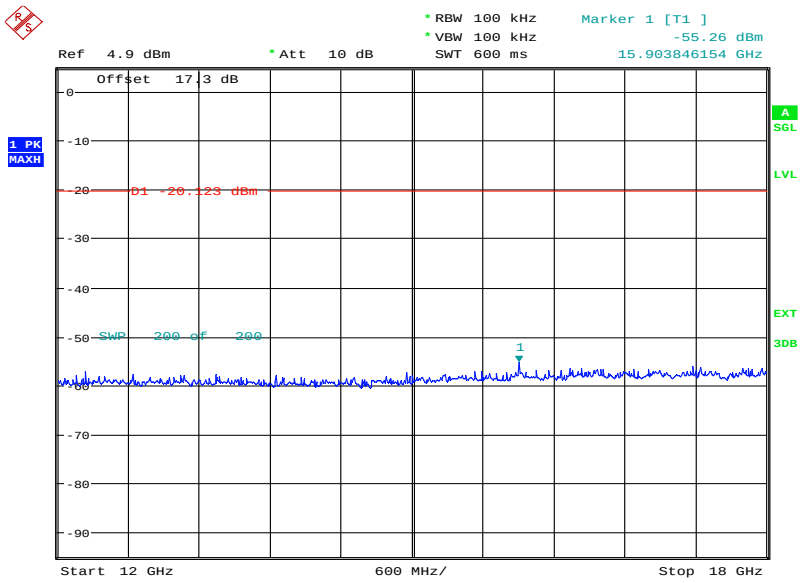
Product Service

4 GHz to 12 GHz



Date: 16.JAN.2014 14:01:42

12 GHz to 18 GHz



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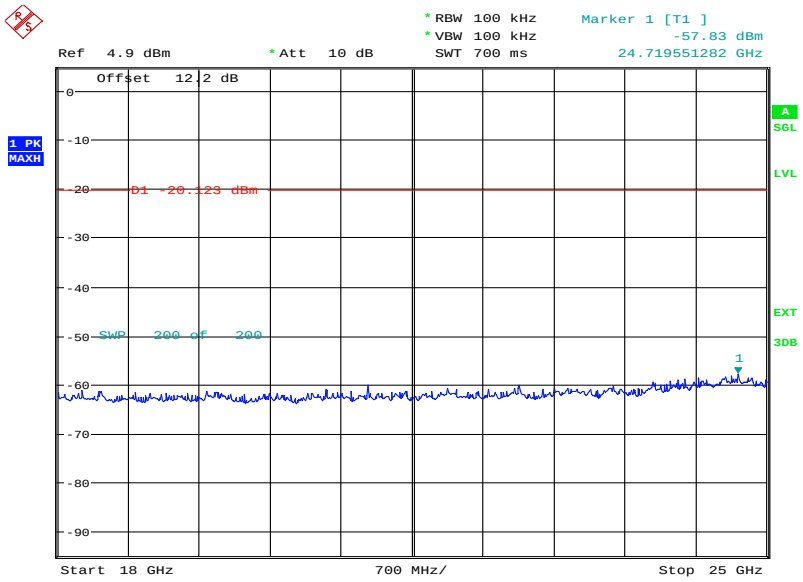
Product Service

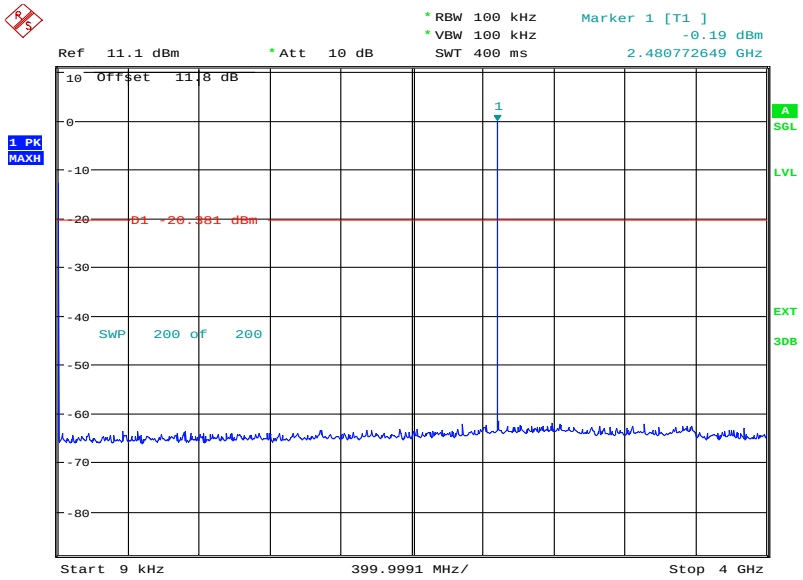
18 GHz to 25 GHz



Date: 16.JAN.2014 17:06:34

2480 MHz

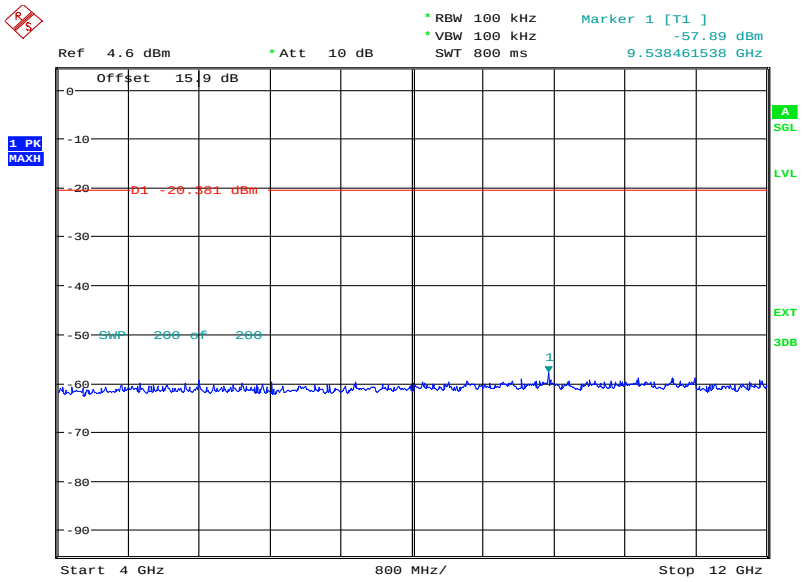
9 kHz to 4 GHz



Date: 16.JAN.2014 13:46:32

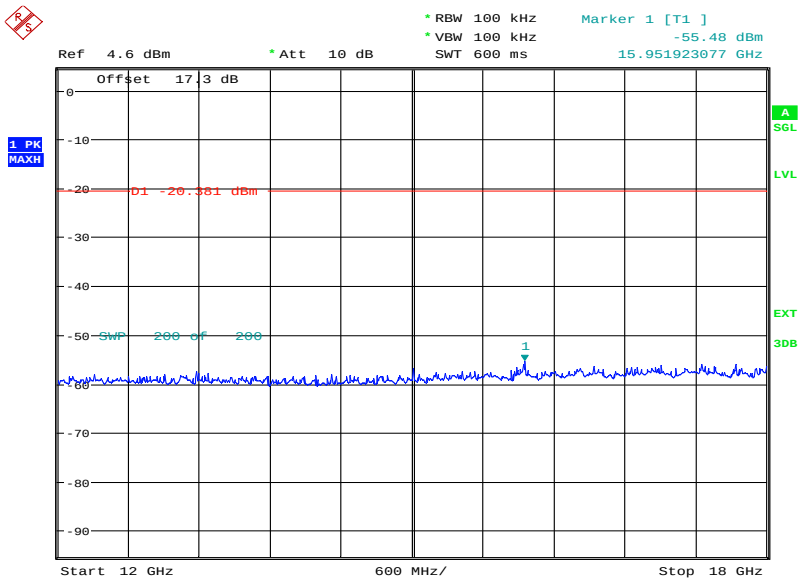
Product Service

4 GHz to 12 GHz



Date: 16.JAN.2014 13:52:09

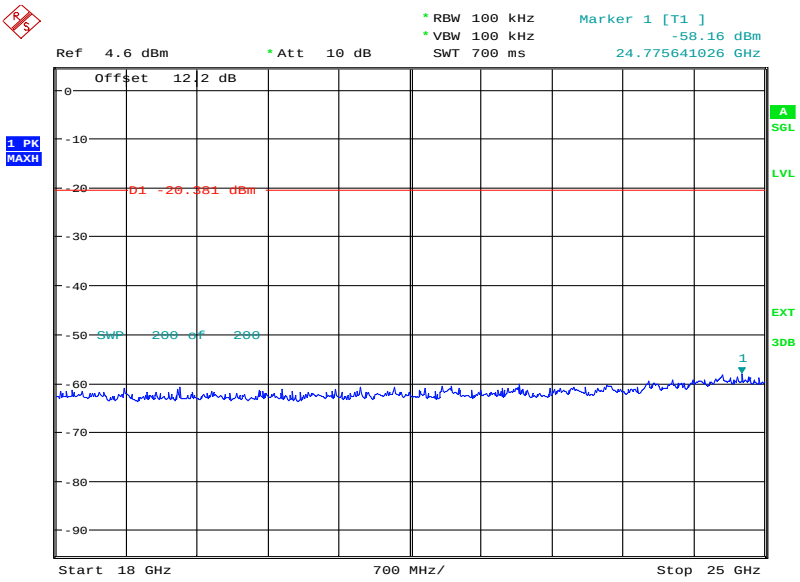
12 GHz to 18 GHz



Date: 16.JAN.2014 13:58:07

Product Service

18 GHz to 25 GHz



Date: 16.JAN.2014 17:09:46

Limit Clause

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

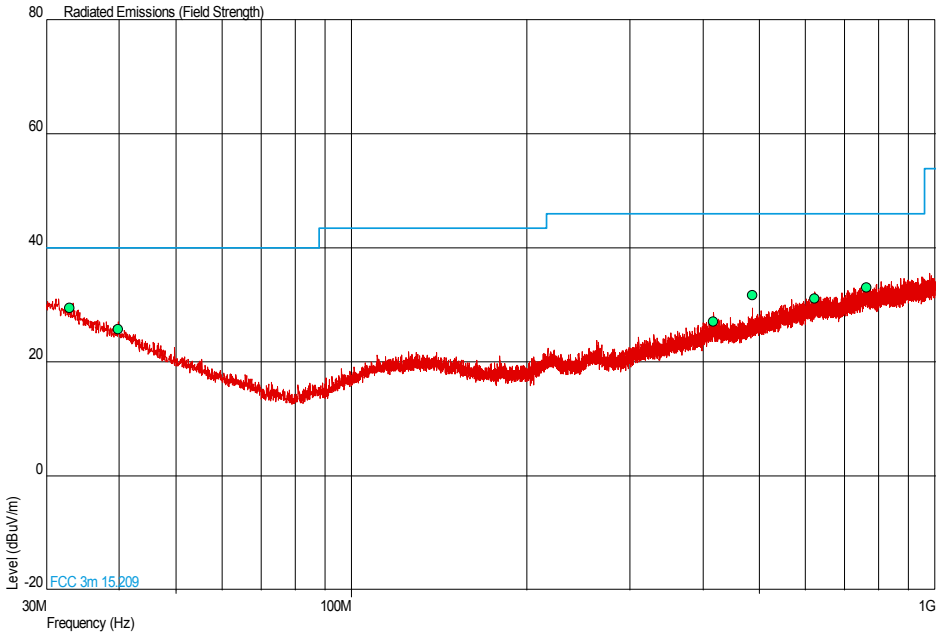
If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval the attenuation required shall be 30 dB instead of 20 dB.

Product Service

Spurious Radiated Emissions

2402 MHz

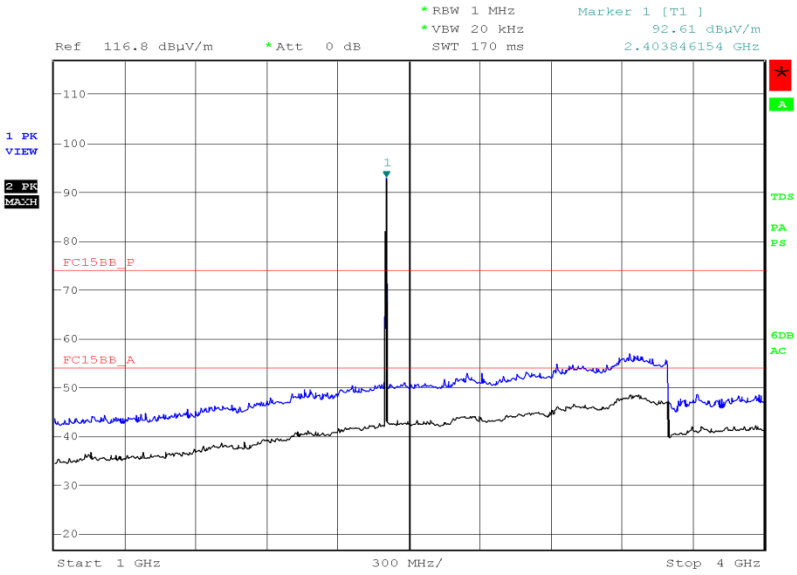
30 MHz to 1 GHz



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
32.955	29.5	29.9	40.0	100	-10.5	70.1	316	1.00	Horizontal
39.904	25.8	19.5	40.0	100	-14.2	80.5	272	1.12	Vertical
417.577	27.1	22.6	46.0	200	-18.9	177.4	233	1.02	Horizontal
486.191	31.7	38.5	46.0	200	-14.3	161.5	0	1.00	Vertical
621.293	31.1	35.9	46.0	200	-14.9	164.1	96	1.00	Horizontal
762.700	33.0	44.7	46.0	200	-13.0	155.3	325	1.00	Horizontal

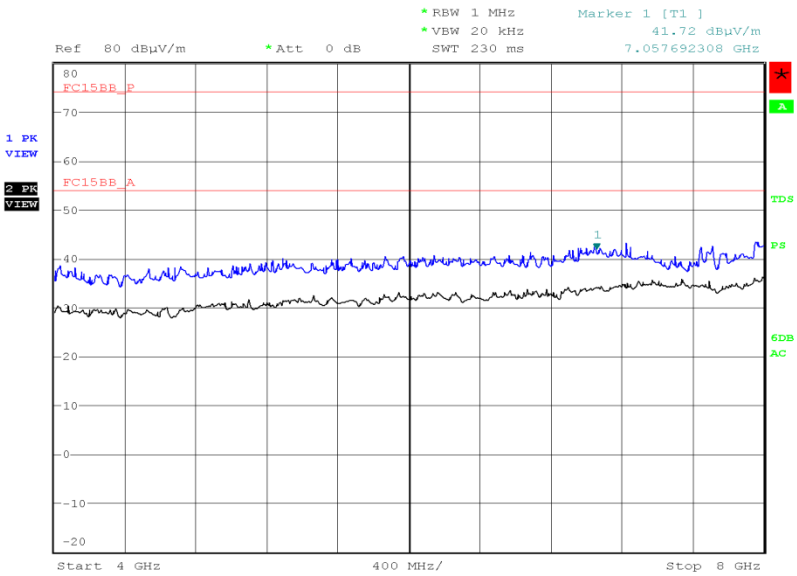
Product Service

1 GHz to 3 GHz



Date: 18.JAN.2014 23:41:33

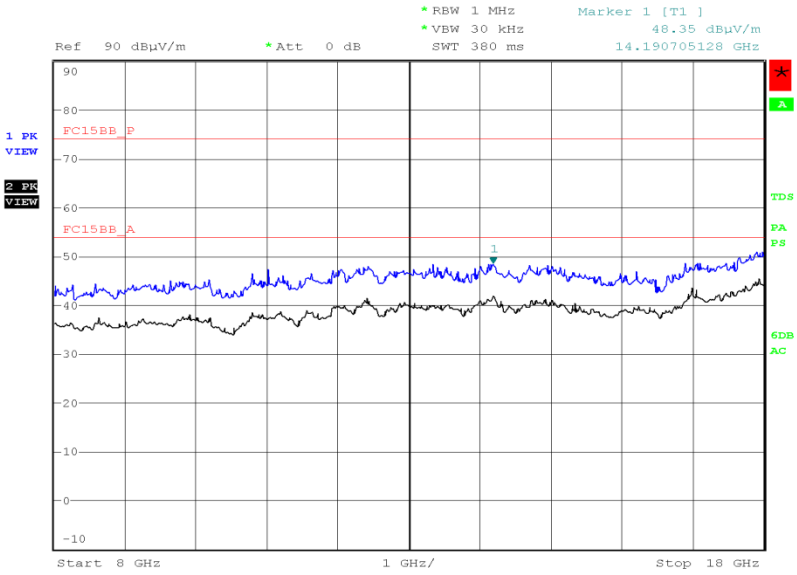
3 GHz to 8 GHz



Date: 18.JAN.2014 21:09:50

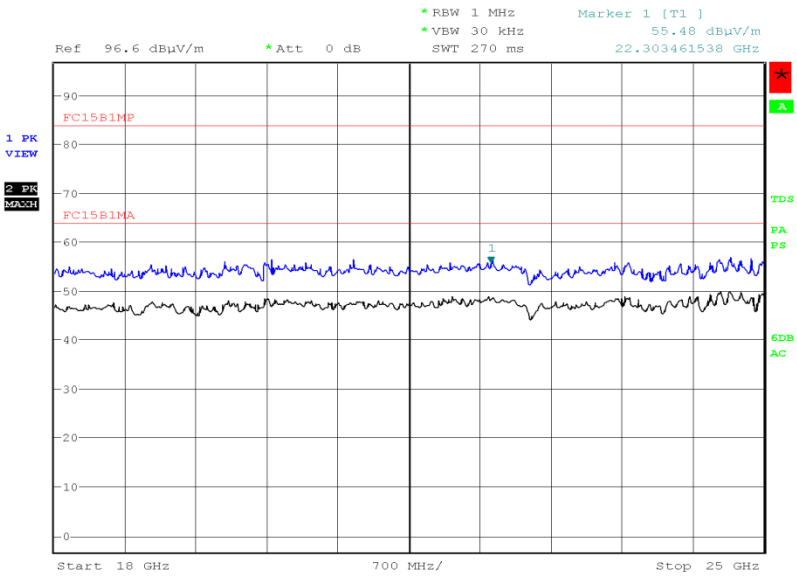
Product Service

8 GHz to 18 GHz



Date: 19.JAN.2014 01:00:30

18 GHz to 25 GHz

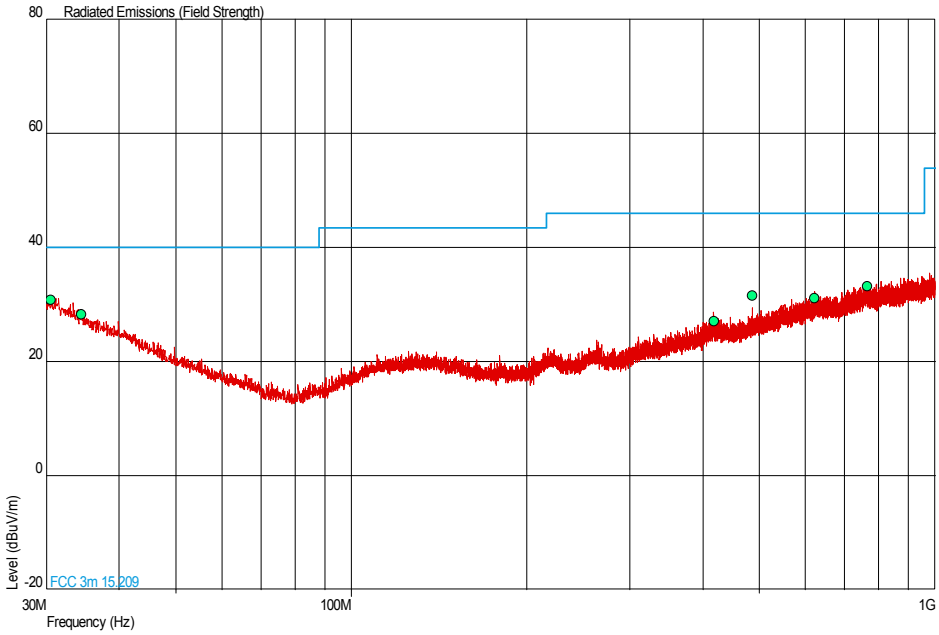


Date: 19.JAN.2014 05:26:32

Product Service

2441 MHz

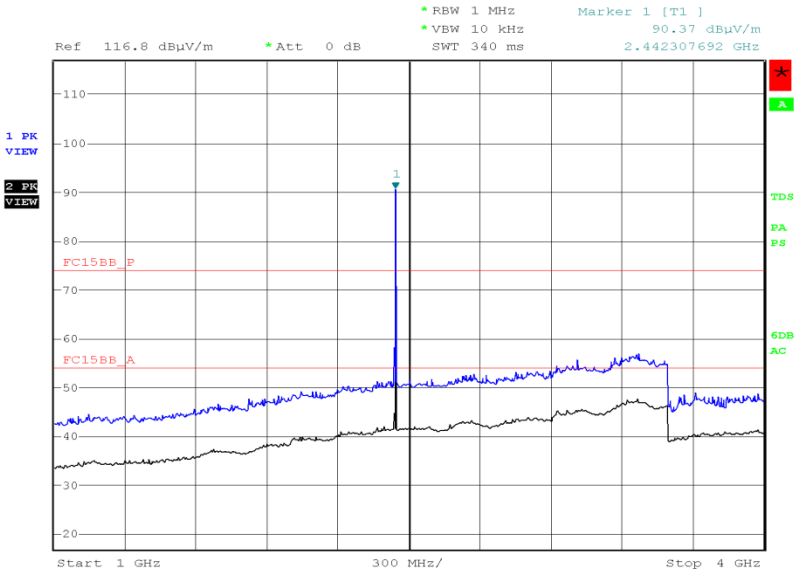
30 MHz to 1 GHz



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
30.585	30.8	34.7	40.0	100	-9.2	65.3	331	1.80	Horizontal
34.511	28.3	26.0	40.0	100	-11.7	74.0	0	3.99	Horizontal
417.691	27.1	22.6	46.0	200	-18.9	177.4	172	1.00	Horizontal
486.191	31.6	38.0	46.0	200	-14.4	162.0	360	1.00	Vertical
621.154	31.1	35.9	46.0	200	-14.9	164.1	353	1.00	Horizontal
766.897	33.2	45.7	46.0	200	-12.8	154.3	164	1.00	Vertical

Product Service

1 GHz to 3 GHz



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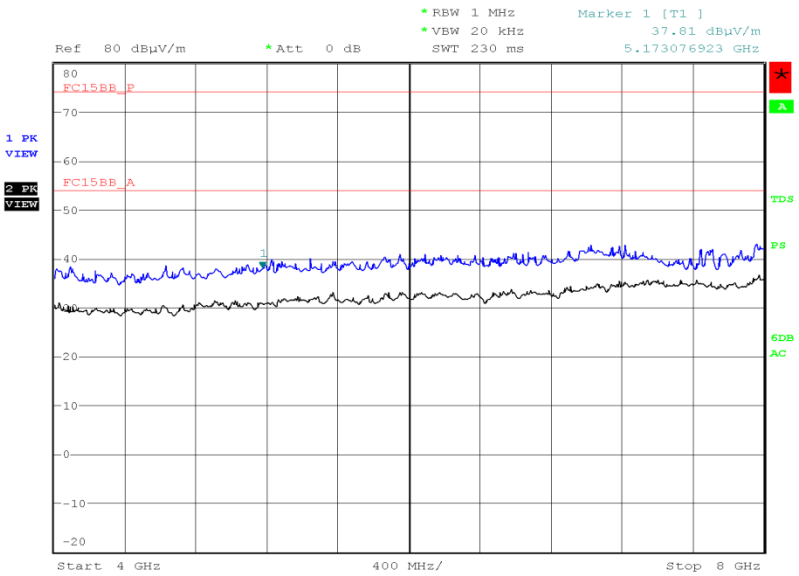
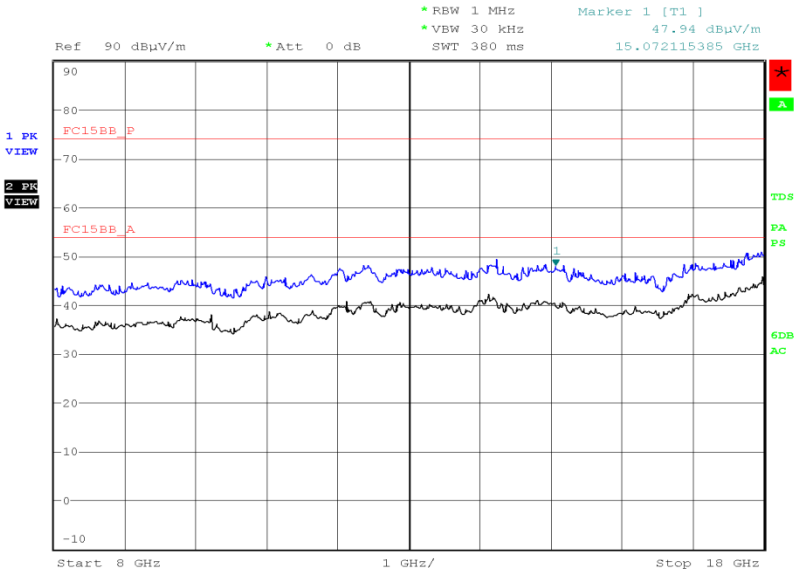
3 GHz to 8 GHz



Date: 18.JAN.2014 21:15:28

Product Service

8 GHz to 18 GHz



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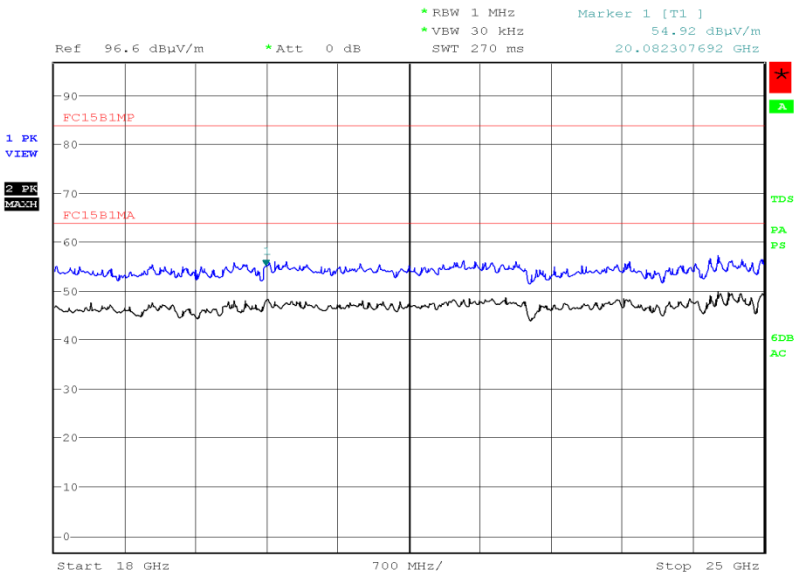
18 GHz to 25 GHz



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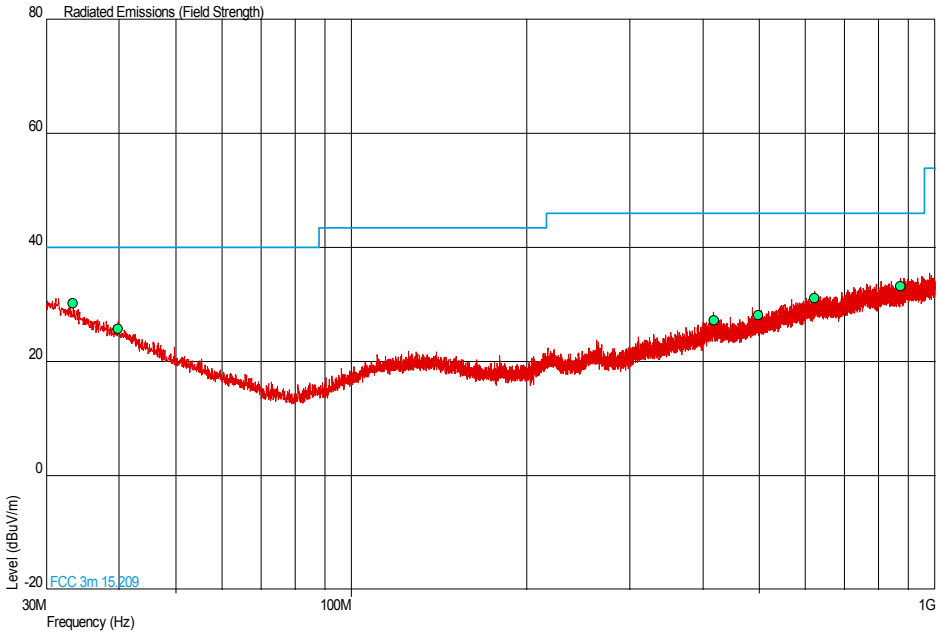
Product Service

2480 MHz

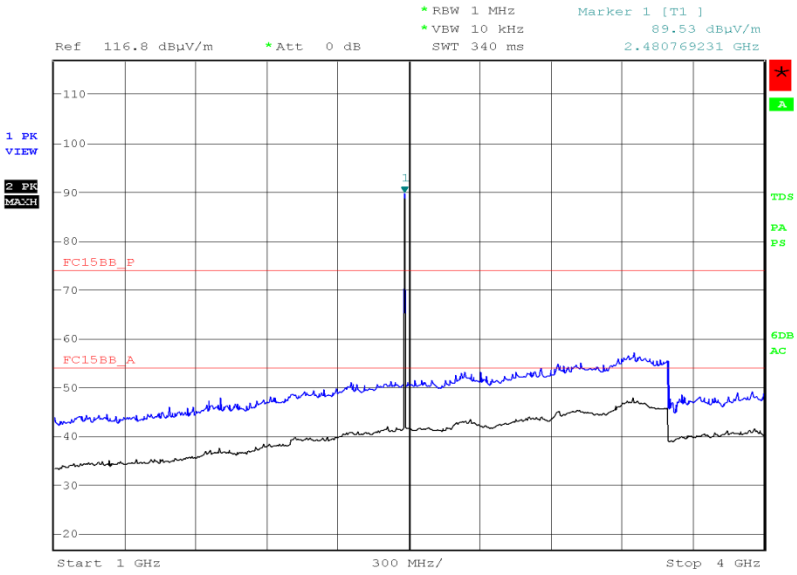
30 MHz to 1 GHz



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
33.353	30.3	32.7	40.0	100	-9.7	67.3	235	2.95	Vertical
39.903	25.8	19.5	40.0	100	-14.2	80.5	242	1.00	Vertical
417.590	27.2	22.9	46.0	200	-18.8	177.1	0	1.49	Horizontal
498.786	28.1	25.4	46.0	200	-17.9	174.6	188	1.00	Horizontal
621.293	31.1	35.9	46.0	200	-14.9	164.1	318	1.00	Horizontal
873.677	33.2	45.7	46.0	200	-12.8	154.3	271	3.27	Vertical

Product Service

1 GHz to 3 GHz



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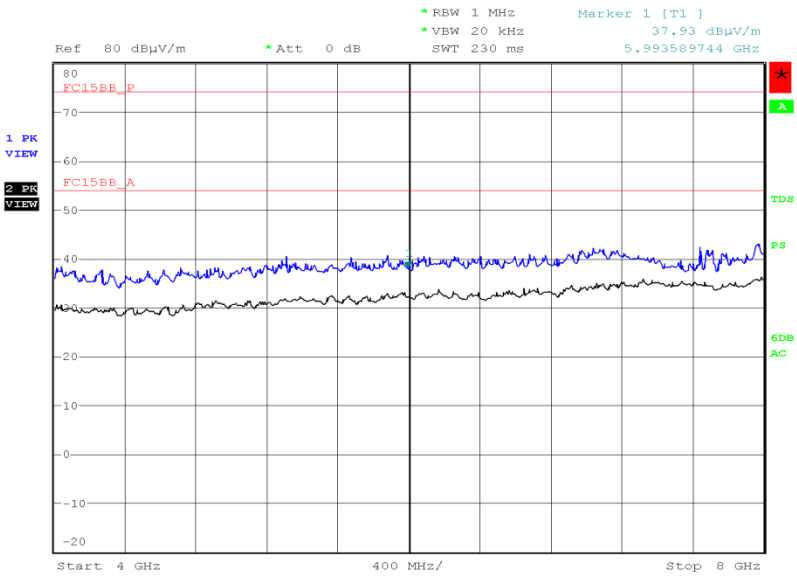
3 GHz to 8 GHz



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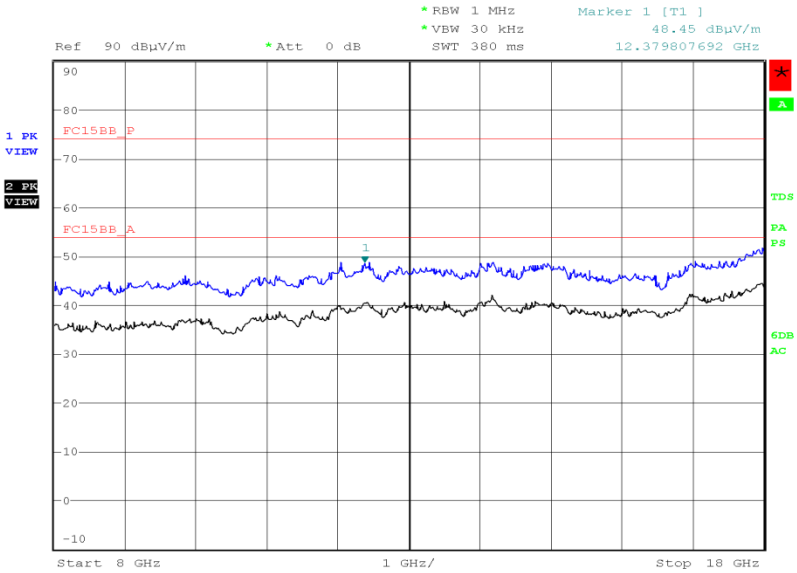
Product Service

8 GHz to 18 GHz



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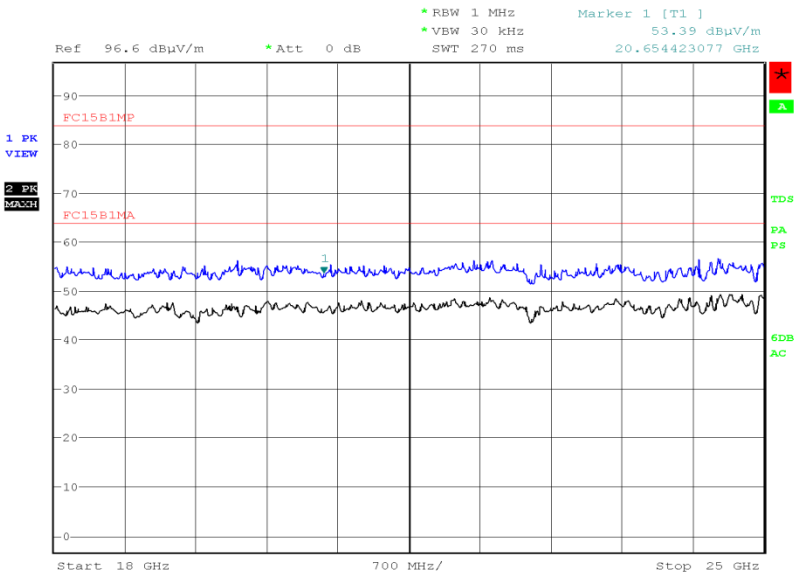
18 GHz to 25 GHz



Date: 19.JAN.2014 05:30:30

Limit

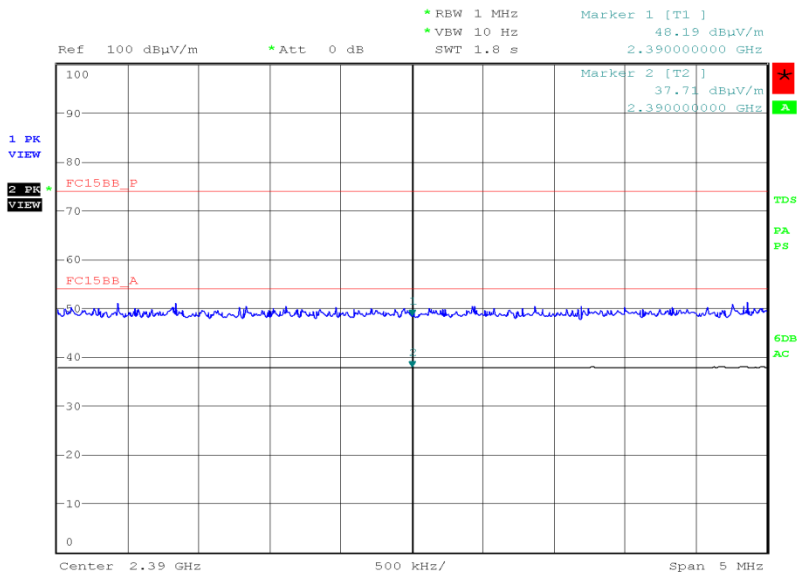
Peak (dBµV/m)	Average (dBµV/m)
74.0	54.0

Product Service

Band Edge Emissions

2402 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Horizontal	48.19	37.71

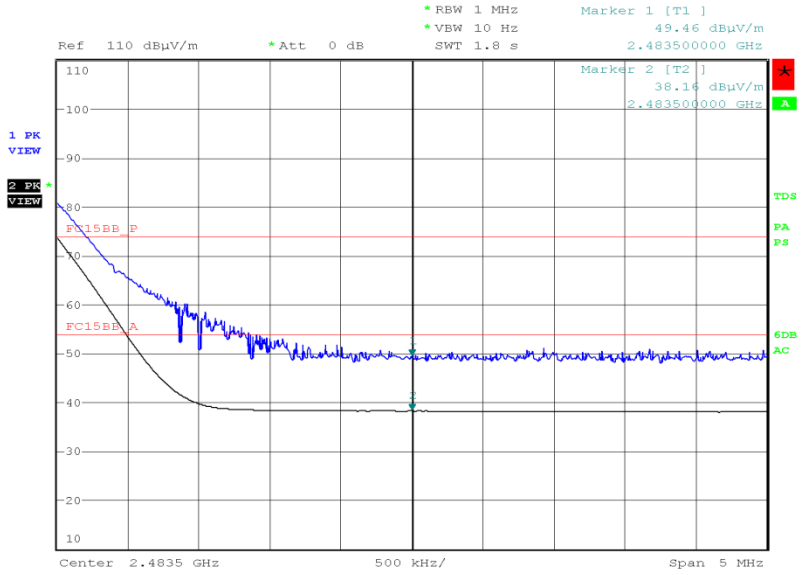


Date: 17.JAN.2014 04:33:36

Product Service

2480 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Horizontal	49.46	38.16



Date: 17.JAN.2014 04:38:30

Limit

Peak (dBµV/m)	Average (dBµV/m)
74.0	54.0

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					
LISN (1 Phase)	Chase	MN 2050	336	12	28-Mar-2014
Screened Room (5)	Rainford	Rainford	1545	36	25-Jan-2014
Transient Limiter	Hewlett Packard	11947A	2377	12	13-Feb-2014
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Oct-2014
7m Armoured RF Cable	SSI Cable Corp.	1501-13-13-7m WA(-)	3600	-	TU
Section 2.2 - Frequency Hopping Systems - 20dB Bandwidth and Channel Separation					
Power Supply Unit	Farnell	LT-30-2	41	-	O/P Mon
Multimeter	White Gold	WG022	190	12	28-Oct-2014
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	24-Jan-2014
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	15-Nov-2014
Hygrometer	Rotronic	I-1000	3220	12	16-Jul-2014
Power Divider	Weinschel	1506A	3345	12	23-May-2014
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	4-Jul-2014
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	13-Sep-2014
DC - 12.4 GHz 10 dB Attenuator	Suhner	6810.17.A	3965	12	17-Oct-2014
P-Series Power Meter	Agilent Technologies	N1911A	3981	12	18-Sep-2014
50 MHz-18 GHz Wideband Power Sensor	Agilent Technologies	N1921A	3983	12	18-Sep-2014
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	18-Sep-2014
Section 2.3 - Frequency Hopping Systems - Channel Dwell Time and Number of Hopping Channels					
Power Supply Unit	Farnell	LT-30-2	41	-	O/P Mon
Multimeter	White Gold	WG022	190	12	28-Oct-2014
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	24-Jan-2014
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	15-Nov-2014
Hygrometer	Rotronic	I-1000	3220	12	16-Jul-2014
Power Divider	Weinschel	1506A	3345	12	23-May-2014
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	4-Jul-2014
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	13-Sep-2014
DC - 12.4 GHz 10 dB Attenuator	Suhner	6810.17.A	3965	12	17-Oct-2014
P-Series Power Meter	Agilent Technologies	N1911A	3981	12	18-Sep-2014
50 MHz-18 GHz Wideband Power Sensor	Agilent Technologies	N1921A	3983	12	18-Sep-2014
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	18-Sep-2014

Product Service

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.4- Maximum Peak Conducted Output Power					
Power Supply Unit	Farnell	LT-30-2	41	-	O/P Mon
Multimeter	White Gold	WG022	190	12	28-Oct-2014
RF Coupler	TUV SUD Product Service	RFC1	414	-	TU
Spectrum Analyser	Agilent Technologies	E4407B	1154	12	13-Aug-2014
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	24-Jan-2014
Multimeter	Iso-tech	IDM101	2424	12	12-Sep-2014
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	15-Nov-2014
Hygrometer	Rotronic	I-1000	3220	12	16-Jul-2014
Power Divider (N) 1W	Weinschel	1506A	3344	12	28-Jun-2014
Power Divider	Weinschel	1506A	3345	12	23-May-2014
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	4-Jul-2014
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	13-Sep-2014
DC - 8 GHz Attenuator	Lucas Weinschel	24-30-33	3963	12	27-Jun-2014
DC - 12.4 GHz 10 dB Attenuator	Suhner	6810.17.A	3965	12	17-Oct-2014
P-Series Power Meter	Agilent Technologies	N1911A	3980	12	18-Sep-2014
P-Series Power Meter	Agilent Technologies	N1911A	3981	12	18-Sep-2014
50 MHz-18 GHz Wideband Power Sensor	Agilent Technologies	N1921A	3982	12	18-Sep-2014
50 MHz-18 GHz Wideband Power Sensor	Agilent Technologies	N1921A	3983	12	18-Sep-2014
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	18-Sep-2014
Section 2.5 - EIRP Peak Power					
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	3-Apr-2014
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	235	12	8-Nov-2014
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Signal Generator (10MHz to 40GHz)	Rohde & Schwarz	SMR40	3171	12	10-Sep-2014
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Oct-2014
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
Section 2.6 - Spurious and Band Edge Emissions					
Power Supply Unit	Farnell	LT-30-2	41	-	O/P Mon
Multimeter	White Gold	WG022	190	12	28-Oct-2014
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	3-Apr-2014
Antenna (Bilog)	Schaffner	CBL6143	287	24	18-Jan-2014
Dual Power Supply Unit	Thurlby	PL320	288	-	TU
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	24-Jan-2014
Antenna (Double Ridge Guide)	Q-Par Angus Ltd	QSH 180K	1511	24	7-Nov-2014
Pre-Amplifier	Phase One	PS04-0086	1533	12	19-Dec-2014
Pre-Amplifier	Phase One	PSO4-0087	1534	12	30-Sep-2014
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
High Pass Filter (4GHz)	RLC Electronics	F-100-4000-5-R	2773	12	1-Feb-2014
Hygrometer	Rotronic	I-1000	3220	12	16-Jul-2014
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Oct-2014
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	4-Jul-2014
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	13-Sep-2014
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
DC - 12.4 GHz 10 dB Attenuator	Suhner	6810.17.A	3965	12	17-Oct-2014
1GHz to 8GHz Low Noise Amplifier	Wright Technologies	APS04-0085	4365	12	1-Oct-2014
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	18-Sep-2014

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	30MHz to 1GHz: ± 5.1 dB 1GHz to 40GHz: ± 6.3 dB
AC Line Conducted Emissions	± 3.2 dB

Product Service

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).

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