



FCC 47 CFR PART 15 SUBPART C: 2012 AND ANSI C63.4: 2009

TEST REPORT

For

Smart Handle

Model Number: ZSH

Brand: UniSmart Handle Pro

Issued for

ZMI Electronics, Ltd

6F-1, 286-4, Shin Ya Road, Kaohsiung, Taiwan 806

Issued by

Compliance Certification Services Inc.

Tainan Lab.

No.8, Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)

TEL: 886-6-580-2201

FAX: 886-6-580-2202

Issued Date: August 28, 2014



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1. TEST REPORT CERTIFICATION

Applicant : ZMI Electronics, Ltd
Address : 6F-1, 286-4, Shin Ya Road, Kaohsiung, Taiwan 806
Manufacturer : ZMI Electronics, Ltd
Address : 6F-1, 286-4, Shin Ya Road, Kaohsiung, Taiwan 806
Equipment Under Test : Smart Handle
Model Number : ZSH
Brand Name : UniSmart Handle Pro
Date of Test : August 07, 2014 ~ August 21, 2014

APPLICABLE STANDARD	
STANDARD	TEST RESULT
FCC Part 15 Subpart C: 2012 AND ANSI C63.4 : 2009	No non-compliance noted

Approved by:


Jeter Wu
Assistant Manager

Reviewed by:


Eric Huang
Assistant Section Manager



2. EUT DESCRIPTION

Product Name	Smart Handle
Model Number	ZSH
Brand Name	UniSmart Handle Pro
Received Date	August 06, 2014
Operating Frequency Range	DSSS Mode : 2402MHz~2480MHz
Transmit Power	DSSS Mode : -3.68dBm (0.429mW)
Channel Spacing	DSSS Mode : 2 MHz
Channel Number	DSSS Mode : 40 Channels
Transmit Data Rate	DSSS Mode : 1 Mbps
Type of Modulation	DSSS : GFSK
Frequency Selection	By software / firmware
Antenna Type	Type: Dipole Model: WMT08410-A Brand: ZMI Gain: -5.64dBi
Power Source	3.7Vdc/900mAh (From Battery) 5.0Vdc/1.2A (From Adapter)
RF Exposure Evaluation	Since the EUT is classed portable device, and the maximum peak power-3.68dBm (0.429mW) is less than the SAR exclusion test threshold. Therefore, SAR test is not required.
Temperature Range	-20 ~ +60°C

Adapter:

No.	Manufacturer	Model	Input	Output
1	GlobTek	GTM41078-0605-USB	100-240Vac, 50/60Hz, 1.2A	5Vdc, 1.2A

Battery:

No.	Manufacturer	Model	Rated
1	Li-Ion	BP11900000CA	3.7Vdc / 900mAh

**REMARK:**

1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.
2. This submittal(s) (test report) is intended for FCC ID: **PDSZSHRP201400YPM** filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.
3. For more details, please refer to the user manual.
4. The different of the each model is shown as bellows:

Multiple Listing :

Company Name	Brand name	Model	Product Name
Patterson Medical Products, Inc.	Rolyan® Smart Handle Pro	ZSH-RP	Smart Handle Pro



3. DESCRIPTION OF TEST MODES

The EUT is a Smart Handle.

The RF module is manufactured by ISSC Technologies Corp.

The antenna peak gain -5.64Bi (highest gain) were chosen for full testing.

DSSS mode

The EUT had been tested under operating condition.

There are three channels have been tested as following:

Channel	Frequency (MHz)
Low	2402
Middle	2440
High	2480

DSSS mode: 1Mbps long data rates (worst case) were chosen for full testing.

The worst-case data rates are determined according to the description above, based on the investigations by measuring the PSD, peak power and average power across all the data rates, bandwidths, modulations and spatial stream modes.



4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4 and FCC CFR 47 15.207, 15.209 and 15.247 and KDB 558074.

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at No.8, Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)

The sites are constructed in conformance with the requirements of ANSI C63.7:1992, ANSI C63.4: 2009 and CISPR Publication 22.

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with preselectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

5.3 LABORATORY ACCREDITATIONS LISTINGS

The test facilities used to perform radiated and conducted emissions tests are accredited by Taiwan Accreditation Foundation for the specific scope of accreditation under Lab Code: 1109 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by TAF or any agency of the Government. In addition, the test facilities are listed with Federal Communications Commission (registration no: TW-1037 and 455173).



5.4 TABLE OF ACCREDITATIONS AND LISTINGS

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

Taiwan	TAF
---------------	-----

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

Canada	Industry Canada
Germany	TUV NORD
Taiwan	BSMI
USA	FCC

Copies of granted accreditation certificates are available for downloading from our web site, <http://www.ccsrf.com>



6. CALIBRATION AND UNCERTAINTY

6.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

6.2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Radiated Emission, 30 to 200 MHz Test Site : OATS-6	$\pm 3.3456\text{dB}$
Radiated Emission, 200 to 1000 MHz Test Site : OATS-6	$\pm 2.6828\text{dB}$
Radiated Emission, 1 to 8 GHz	$\pm 2.6485\text{dB}$
Radiated Emission, 8 to 18 GHz	$\pm 2.6852\text{dB}$
Radiated Emission, 18 to 26.5 GHz	$\pm 2.6485\text{dB}$
Radiated Emission, 26 to 40 GHz	$\pm 3.0295\text{dB}$
Power Line Conducted Emission	$\pm 1.91\text{dB}$
Band Width	136.49kHz
Peak Output Power MU	$\pm 1.904\text{dB}$
Band Edge MU	$\pm 0.302\text{dBuV}$
Channel Separation MU	361.69Hz
Duty Cycle MU	0.064ms
Frequency Stability MU	0.223kHz

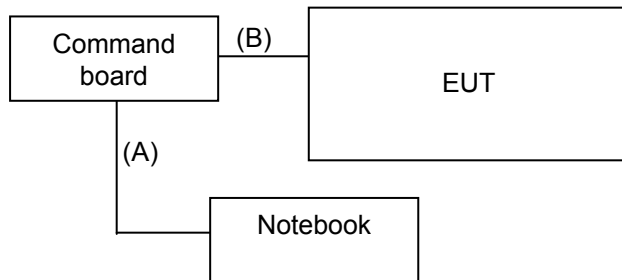
This measurement uncertainty is confidence of approximately 95%, $k=2$



7. SETUP OF EQUIPMENT UNDER TEST

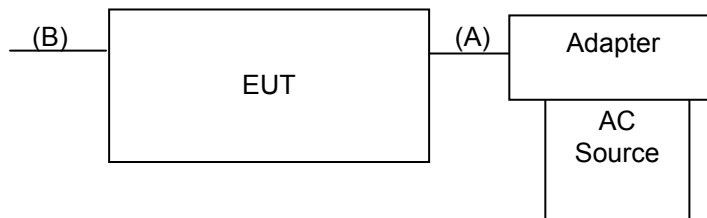
7.1 SETUP CONFIGURATION OF EUT

RF Test Setup:



EMI Test Setup:

Test Mode: Charge mode



Test Mode: Normal Operation mode





7.2 SUPPORT EQUIPMENT

RF test

No.	Product	Manufacturer	Model No.	Certify No.	Signal cable
1	Notebook	Acer	AS 3830TG	DOC	Power cable, unshd, 1.6m

No.	Signal cable description	
A	USB cable	Shielded, 1.8m, 1pcs. with 2 cores
B	Command cable	Unshielded, 0.1m, 1pcs.

EMI test

No.	Product	Manufacturer	Model No.	Certify No.	Signal cable
1.	N/A	---	---	---	---

No.	Signal cable description	
A	DC Power	Unshielded, 1.0m, 1pcs.

REMARK:

1. All the above equipment/cables were placed in worse case positions to maximize emission signals during emission test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.



7.3 EUT OPERATING CONDITION

RF Setup

1. Set up all computers like the setup diagram.
2. The "ISRT" software was used for testing
3. Choose "CREATE" ,Select Driver "IS1677SM_101_SPP_V1.3", "TRIM"
4. Transport "COM5" and BAUDRATE "115200"

TX Mode:

TX :

Tx Modulation > ON

Frequenc > CH0 – 2402MHz (CH0 - CH39)

Length > 0x00

Power > 0x7F

RX Mode:

RX

5. All of the function are under run.
6. Start test.



8. APPLICABLE LIMITS AND TEST RESULTS

8.1 6DB BANDWIDTH

LIMIT

§ 15.207(a) (2) For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz

TEST EQUIPMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSEK 30	835253/002	SEP. 28. 2014

TEST SETUP



TEST PROCEDURE

The tests were performed in accordance with KDB 558074 8.1 & 8.2.

Option 1:

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

Option 2:

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW ≥ 3 RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

**TEST RESULTS**

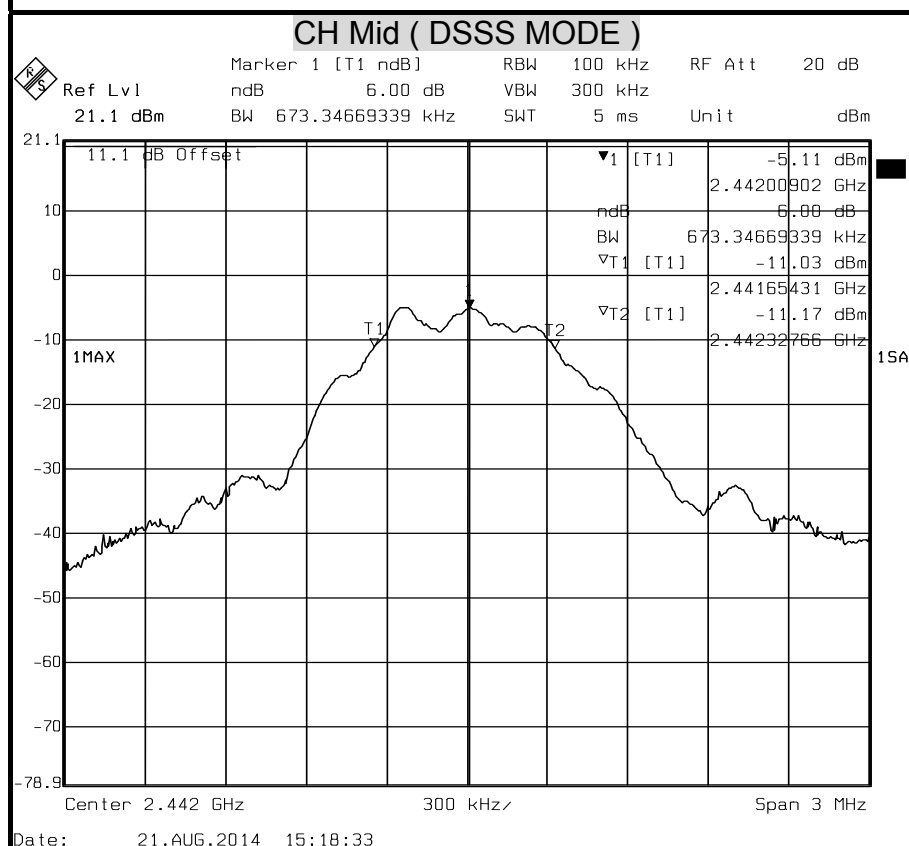
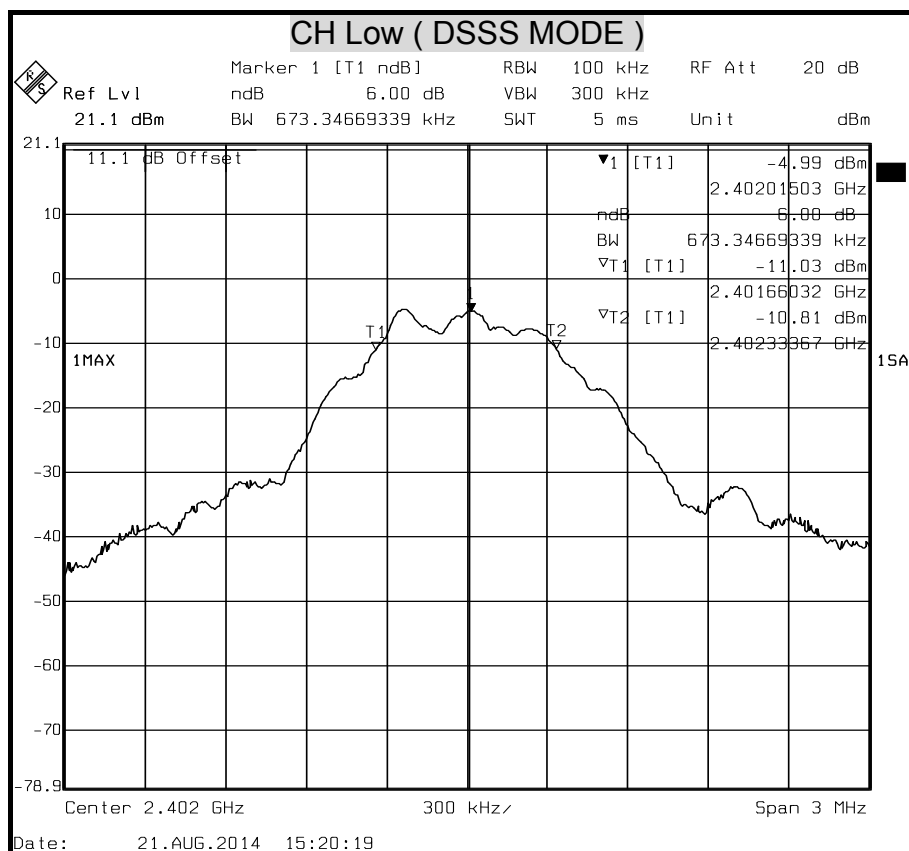
No non-compliance noted.

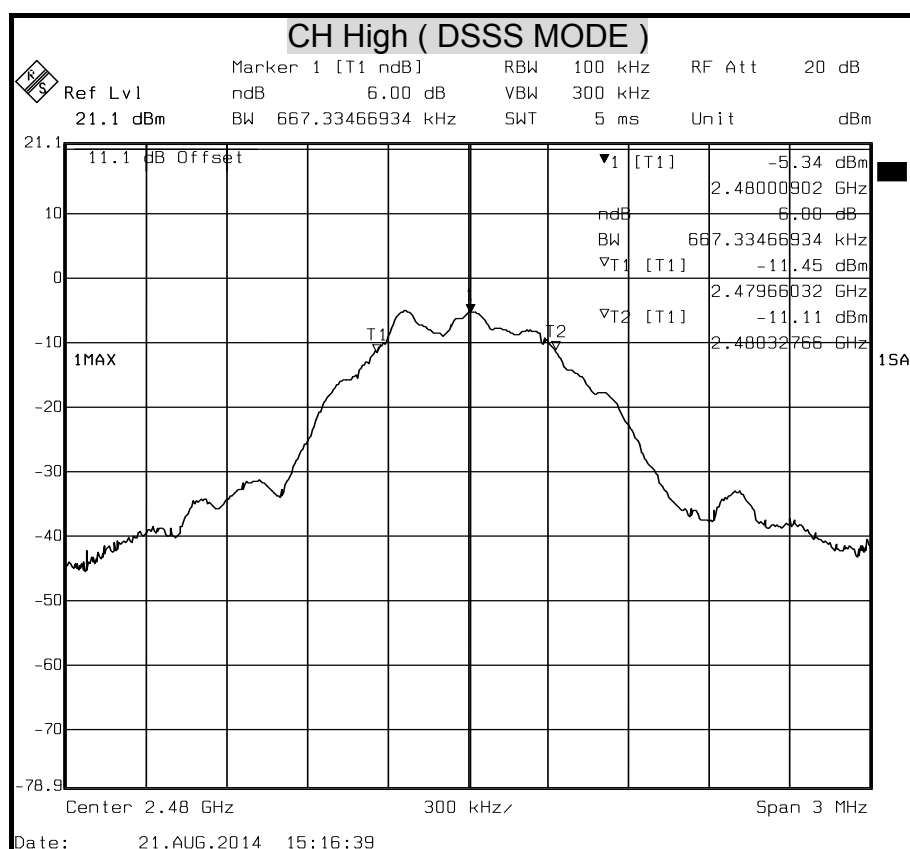
DSSS mode

Channel	Channel Frequency (MHz)	6dB Bandwidth (kHz)	Minimum Limit (kHz)	Pass / Fail
Low	2402	0.67	500	PASS
Middle	2440	0.67	500	PASS
High	2480	0.67	500	PASS

NOTE :

1. At final test to get the worst-case emission at 1Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

**6dB BANDWIDTH (DSSS MODE)**





8.2 MAXIMUM PEAK OUTPUT POWER

LIMIT

§ 15.247(b) The maximum peak output power of the intentional radiator shall not exceed the following :

§ 15.247(b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands : 1 watt.

§ 15.247(b) (4) Except as shown in paragraphs (c) of this section , if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2), and (b)(3) of this section , as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST EQUIPMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSEK 30	835253/002	SEP. 28. 2014
Power Meter	Anritsu	ML2487A	6K00003888	JUN. 24, 2015

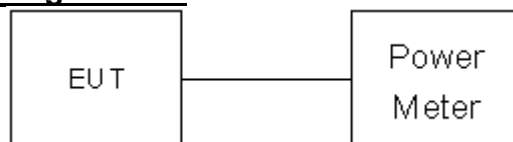
Remark: Each piece of equipment is scheduled for calibration once a year.

TEST SETUP

For Peak Power



For Average Power





TEST PROCEDURE

The tests were performed in accordance with KDB 558074 9.1.2 & 9.2.2.3 .

Integrated band power method

This procedure may be used when the maximum available RBW of the measurement instrument is less than the DTS bandwidth.

- a) Set the RBW = 1 MHz.
- b) Set the VBW ≥ 3 RBW
- c) Set the span $\geq 1.5 \times$ DTS bandwidth.
- d) Detector = peak.
- e) Sweep time = auto couple.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select peak detector). If the instrument does not have a band power function, sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the DTS bandwidth.

Average Power

Connect the EUT to power meter, set the center frequency of the power meter to the channel center frequency.

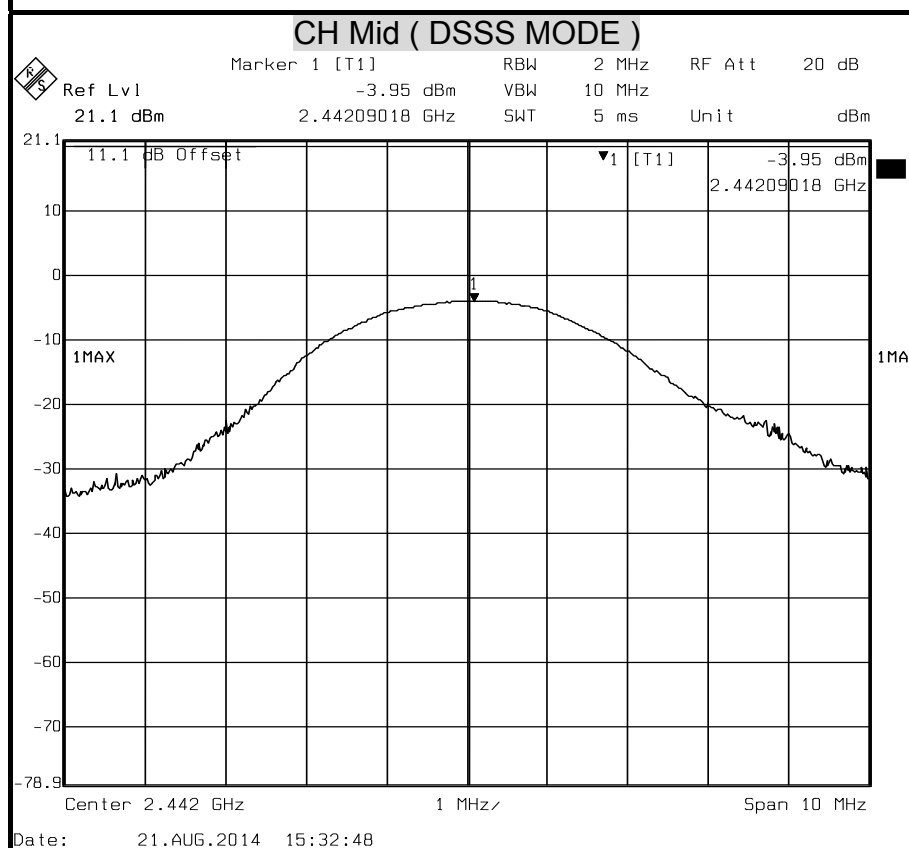
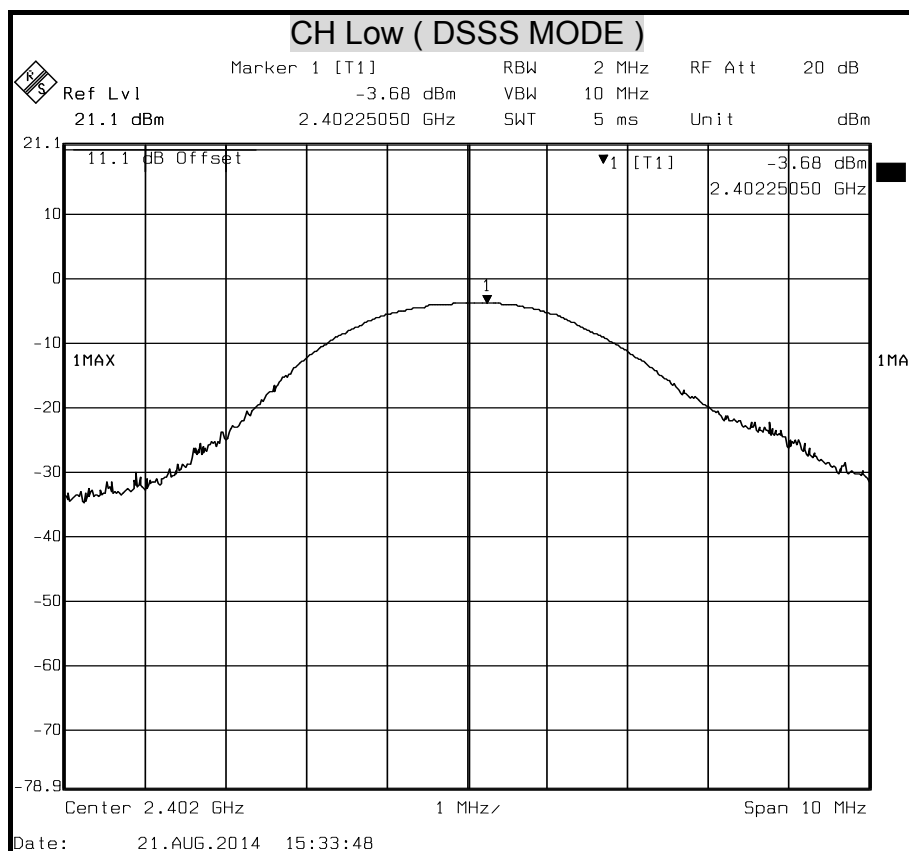
**DSSS mode**

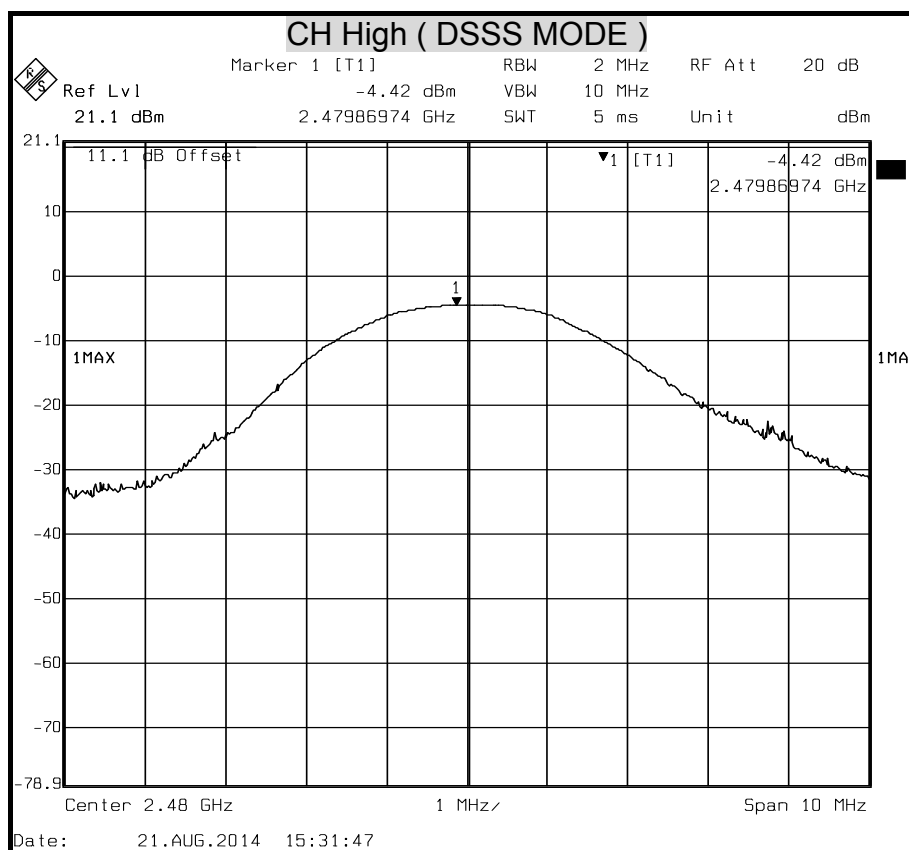
Channel	Channel Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)	Pass / Fail
Low	2402	-3.68	30.00	PASS
Middle	2442	-3.95	30.00	PASS
High	2480	-4.42	30.00	PASS

NOTE : 1. At final test to get the worst-case emission at 1Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Average Power Data**DSSS mode**

Channel	Channel Frequency (MHz)	Average Power (dBm)
Low	2402	-4.42
Middle	2440	-4.72
High	2480	-4.83

**MAXIMUM PEAK OUTPUT POWER (DSSS MODE)**





8.3 MAXIMUM PERMISSIBLE EXPOSURE

According to FCC 1.1310 : The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b) LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time
(A) Limits for Occupational / Control Exposures				
300-1,500	--	--	F/300	6
1,500-100,000	--	--	5	6
(B) Limits for General Population / Uncontrol Exposures				
300-1,500	--	--	F/1500	6
1,500-100,000	--	--	1	30

CALCULATIONS

Given $E = \frac{\sqrt{30 \times P \times G}}{d}$ & $S = \frac{E^2}{3770}$

Where E = Field strength in Volts / meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power density in milliwatts / square centimeter

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{3770 d^2}$$

Changing to units of mW and cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = d \text{ (m)} / 100$$

Yields

$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2}$$

Where d = Distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power density in mW / cm²



LIMIT

Power Density Limit, $S=1.0\text{mW}/\text{cm}^2$

TEST RESULTS

Since the EUT is classed portable device, and the maximum peak power-3.68dBm (0.429mW) is less than the SAR exclusion test threshold. Therefore, SAR test is not required.



8.4 POWER SPECTRAL DENSITY

LIMIT

§ 15.247(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

TEST EQUIPMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSEK 30	835253/002	SEP. 28. 2014

TEST SETUP



TEST PROCEDURE

The tests were performed in accordance with KDB 558074 10.2.

Method PKPSD (peak PSD)

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance, and is optional if the maximum conducted (average) output power was used to demonstrate compliance.

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to 1.5 times the DTS bandwidth.
- Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- Set the VBW $\geq 3 \times \text{RBW}$.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level within the RBW.
- If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

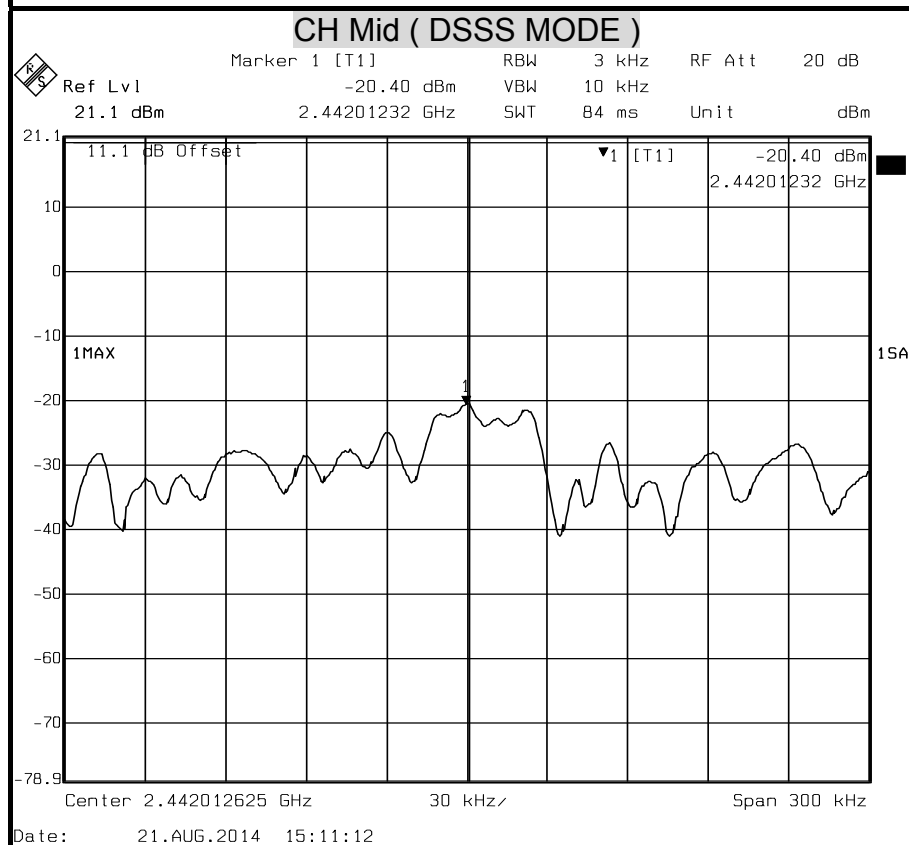
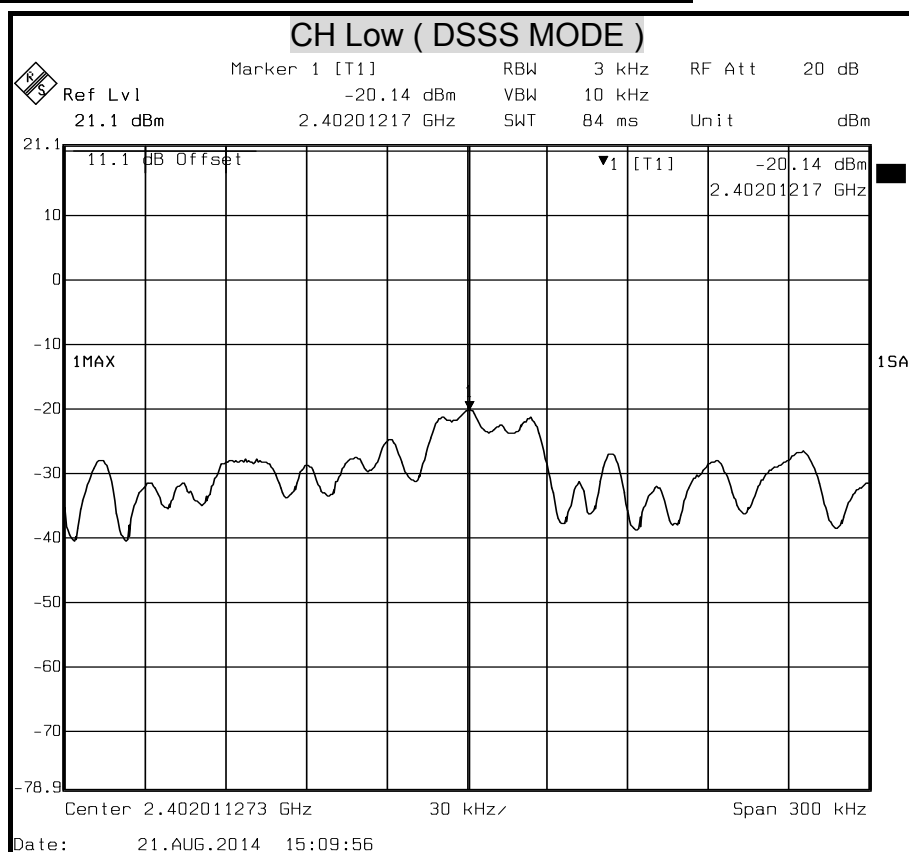
TEST RESULTS

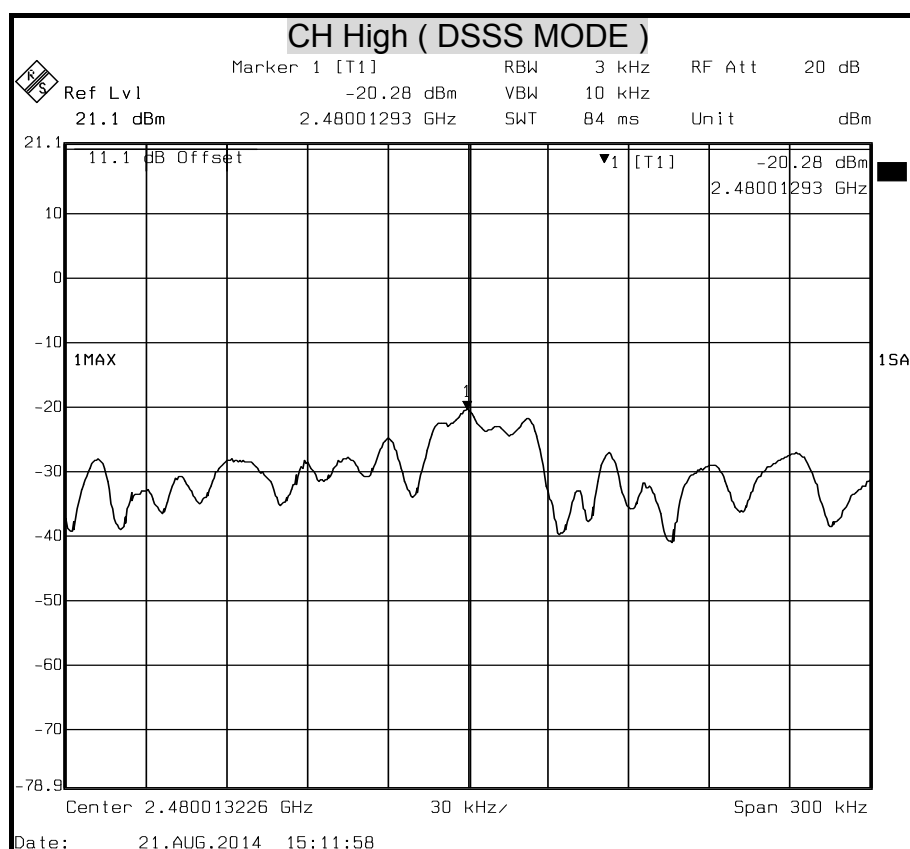
No non-compliance noted.

**DSSS mode**

Channel	Frequency (MHz)	Reading (dBm)	Limit (dBm)	Margin (dB)	Result
Low	2402	-20.14	8.00	-28.14	PASS
Middle	2440	-20.40	8.00	-28.40	PASS
High	2480	-20.28	8.00	-28.28	PASS

NOTE : 1. At final test to get the worst-case emission at 1Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

**POWER SPECTRAL DENSITY (DSSS MODE)**





8.5 CONDUCTED SPURIOUS EMISSION

LIMITS

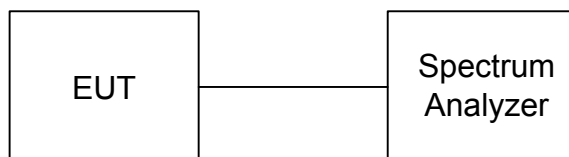
§ 15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSEK 30	835253/002	SEP. 28. 2014

Remark: Each piece of equipment is scheduled for calibration once a year.

TEST SETUP



TEST PROCEDURE

The tests were performed in accordance with KDB 558074 11.2 & 11.3 .

11.2 Reference level measurement

Establish a reference level by using the following procedure:

- Set instrument center frequency to DTS channel center frequency.
- Set the span to ≥ 1.5 times the *DTS bandwidth*.
- Set the RBW = 100 kHz.
- Set the VBW $\geq 3 \times$ RBW.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum PSD level.

Note that the channel found to contain the maximum PSD level can be used to establish the



reference level.

11.3 Emission level measurement

- a) Set the center frequency and span to encompass frequency range to be measured.
- b) Set the RBW = 100 kHz.
- c) Set the VBW $\geq 3 \times$ RBW.
- d) Detector = peak.
- e) Ensure that the number of measurement points \geq span/RBW
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in 11.1 a) or 11.1 b). Report the three highest emissions relative to the limit.

TEST RESULTS

No non-compliance noted.



TEST DATA

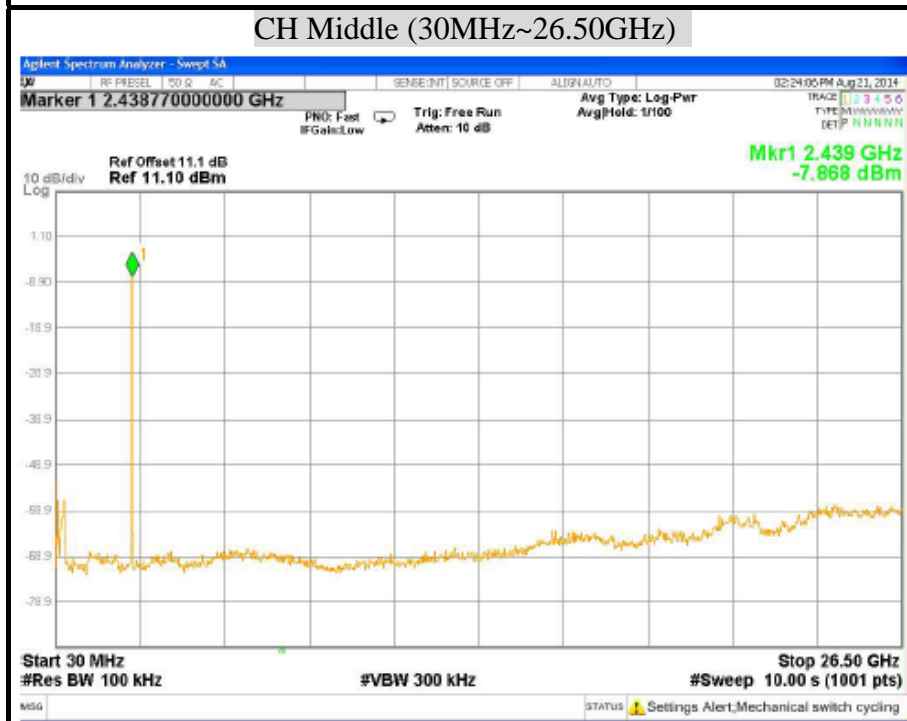
OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT

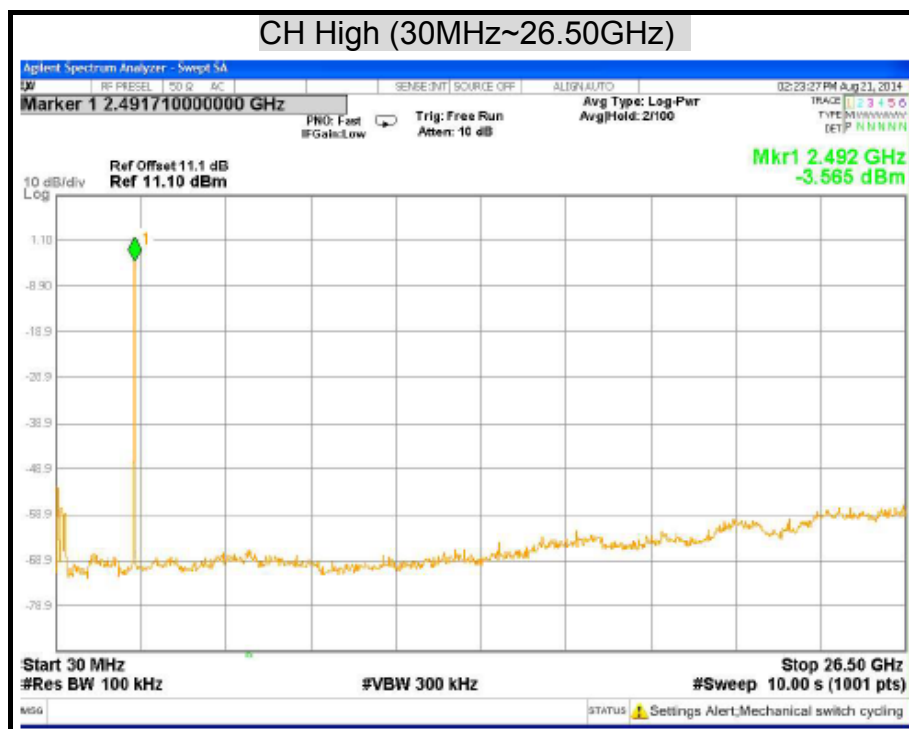
(DSSS MODE)

CH Low (30MHz~26.50GHz)



CH Middle (30MHz~26.50GHz)







8.7 RADIATED EMISSIONS

8.7.1 TRANSMITTER RADIATED SUPURIOUS EMSSIONS

LIMITS

§ 15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3338	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)
13.36 - 13.41			

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² Above 38.6

§ 15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.



§ 15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table :

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz, However, operation within these frequency bands is permitted under other sections of this Part, e-g, Sections 15.231 and 15.241.

§ 15.209 (b) In the emission table above, the tighter limit applies at the band edges.

TEST EQUIPMENTS

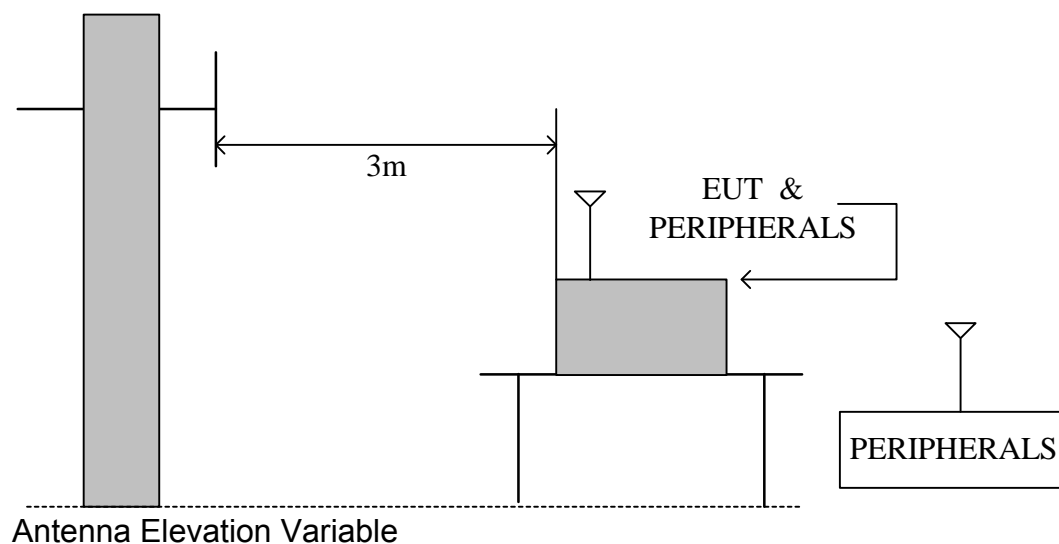
The following test equipments are utilized in making the measurements contained in this report.

Open Area Test Site # 6				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
TYPE N COAXIAL CABLE	SUHNER	CHA9513	6	DEC. 18, 2014
BI-LOG Antenna	Sunol	JB1	A070506-2	SEP. 09, 2014
LOOP ANTENNA	EMCO	6502	8905-2356	JUN. 10, 2015
Pre-Amplifier	UniSmart Handle Pro	8447F	2944A03817	DEC. 18, 2014
Pre-Amplifier	EMCI	EMC 012645	980097	DEC. 20, 2014
EMI Receiver	R&S	ESVS10	833206/012	JUN. 29, 2015
Horn Antenna	Com-Power	AH-118	071032	DEC. 05, 2014
3116 Double Ridge Antenna (40G)	ETS-LINDGREN	3116	00078900	JAN. 27, 2015
Turn Table	Yo Chen	001	-----	N.C.R.
Antenna Tower	AR	TP1000A	309874	N.C.R.
Controller	CT	SC101	-----	N.C.R.
RF Swicth	E-INSTRUMENT TELH LTD	ERS-180A	EC1204141	N.C.R
Spectrum Analyzer	R&S	FSU	200789	SEP. 22. 2014
Spectrum Analyzer	R&S	FSEK 30	835253/002	SEP. 28. 2014
Spectrum Analyzer	Agilent	E4446A	US44300399	MAR. 01. 2015

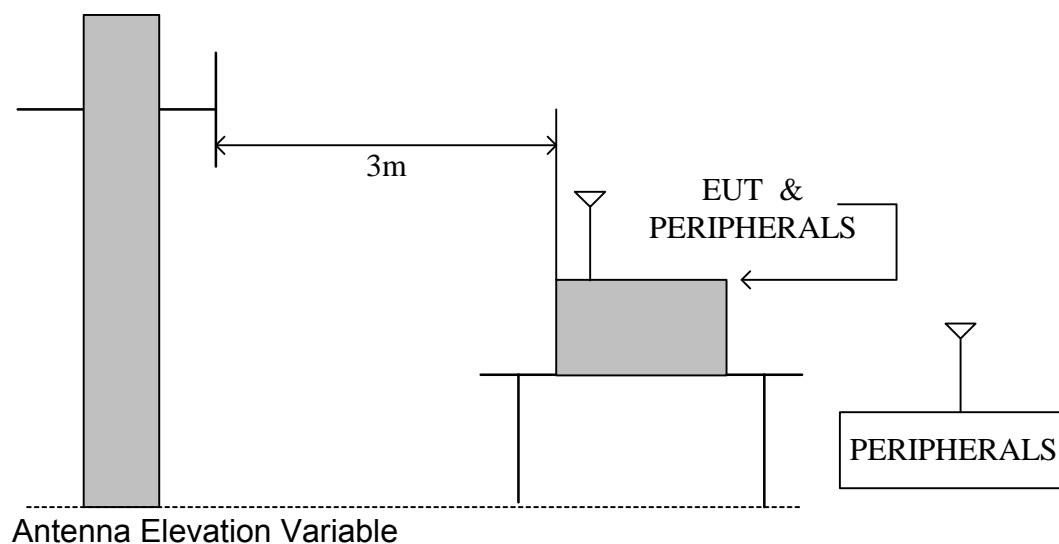


TEST SETUP

The diagram below shows the test setup that is utilized to make the measurements for emission from 30 to 1GHz.



The diagram below shows the test setup that is utilized to make the measurements for emission above 1GHz.





TEST PROCEDURE

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. While measuring the radiated emission below 1GHz, the EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. While measuring the radiated emission above 1GHz, the EUT was set 3 meters away from the interference-receiving antenna
- c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarization of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- g. The tests were performed in accordance with KDB 558074 5.4.

NOTE :

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1GHz.
4. **No emission is found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz)**

TEST RESULTS

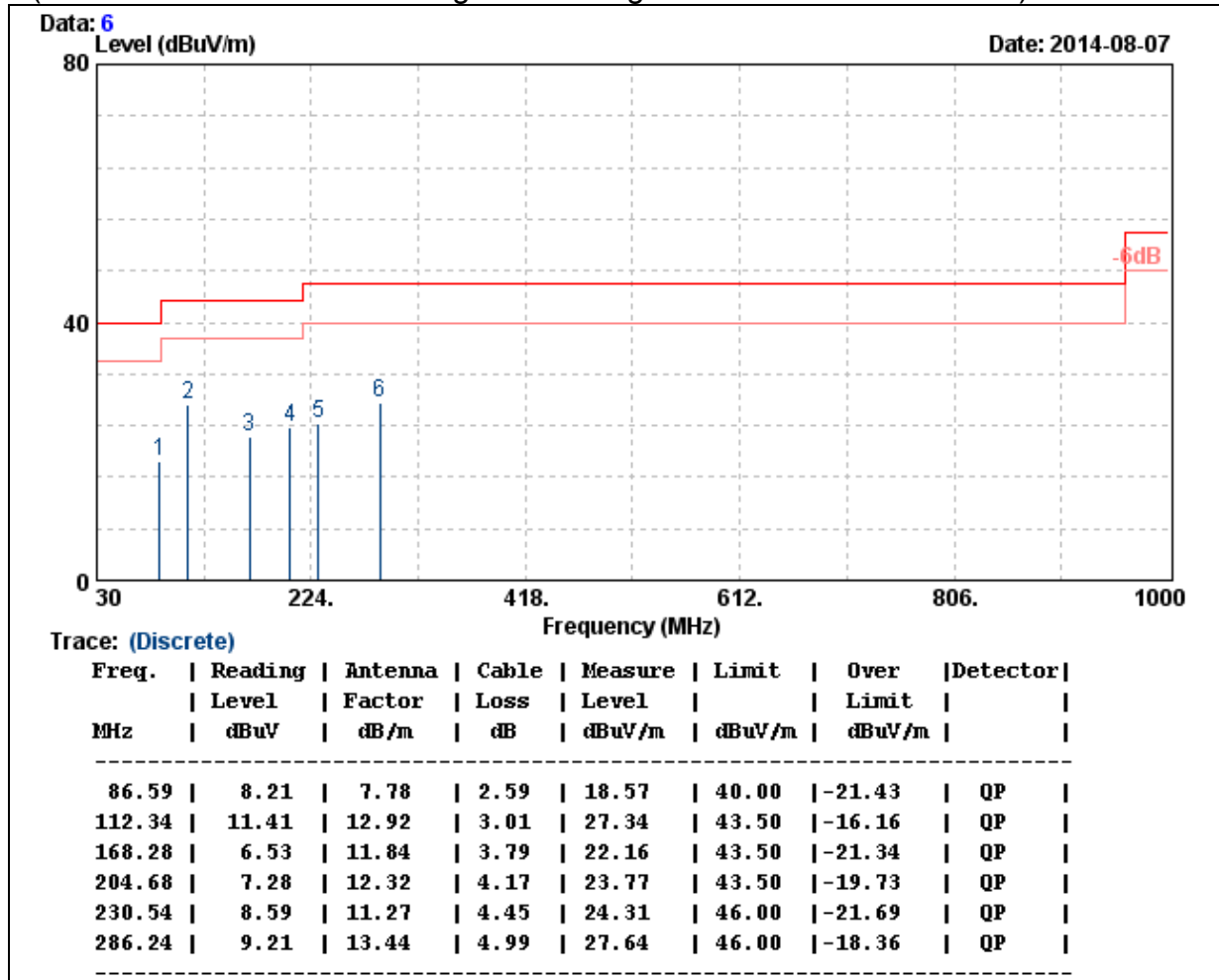
No non-compliance noted.

**8.7.2 WORST-CASE RADIATED EMISSION BELOW 1 GHz**

Product Name	Smart Handle	Test Date	2014/06/21
Model	ZSH	Test By	Taiyu Cyu
Test Mode	Normal Operation / Worst case	TEMP& Humidity	27°C, 44%

Horizontal

(The chart below shows the highest readings taken from the final data.)



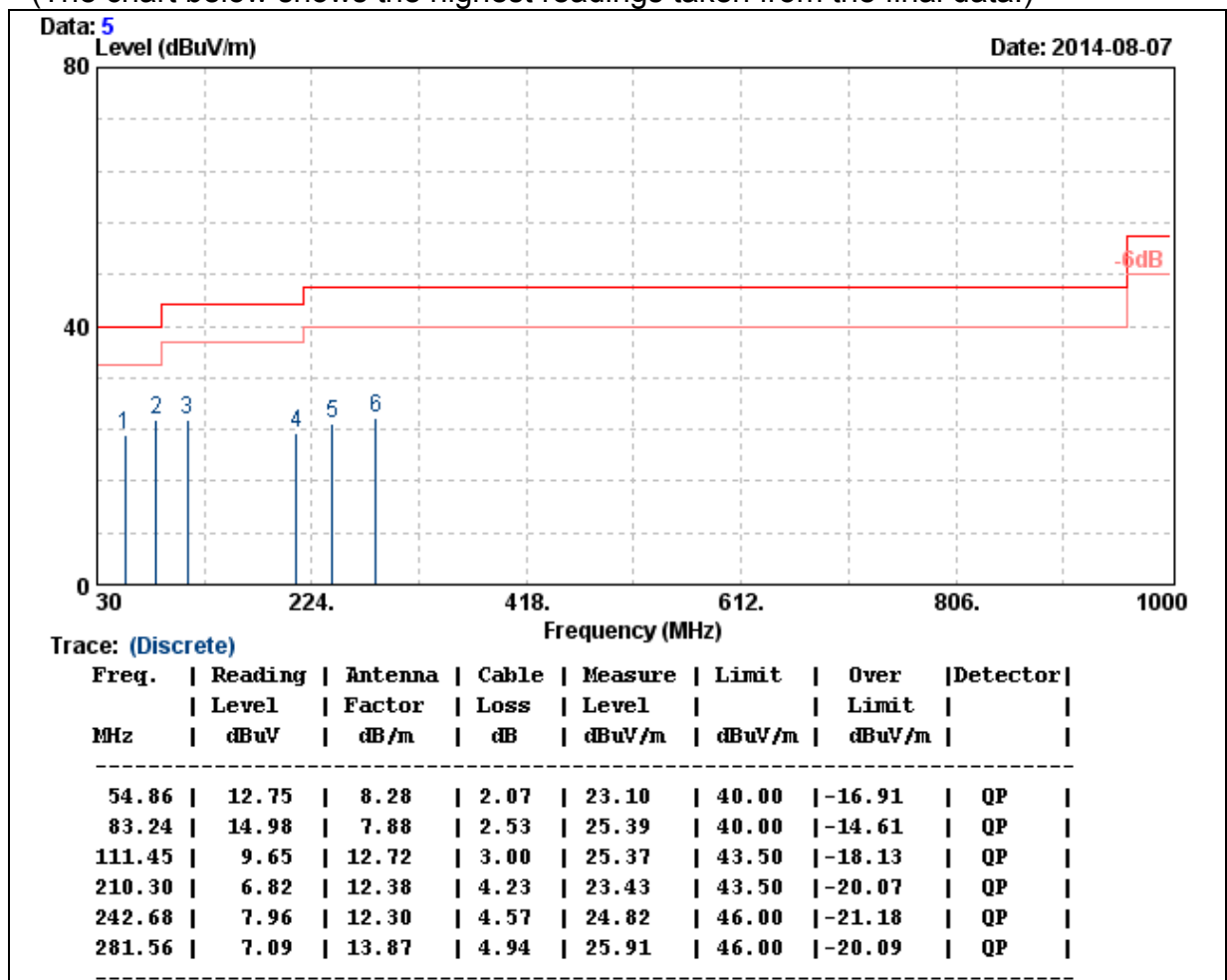
- Note: 1. QP= Quasi-peak Reading.
2. The other emission levels were very low against the limit



Product Name	Smart Handle	Test Date	2014/06/21
Model	ZSH	Test By	Taiyu Cyu
Test Mode	Normal Operation / Worst case	TEMP& Humidity	27°C, 44%

Vertical

(The chart below shows the highest readings taken from the final data.)



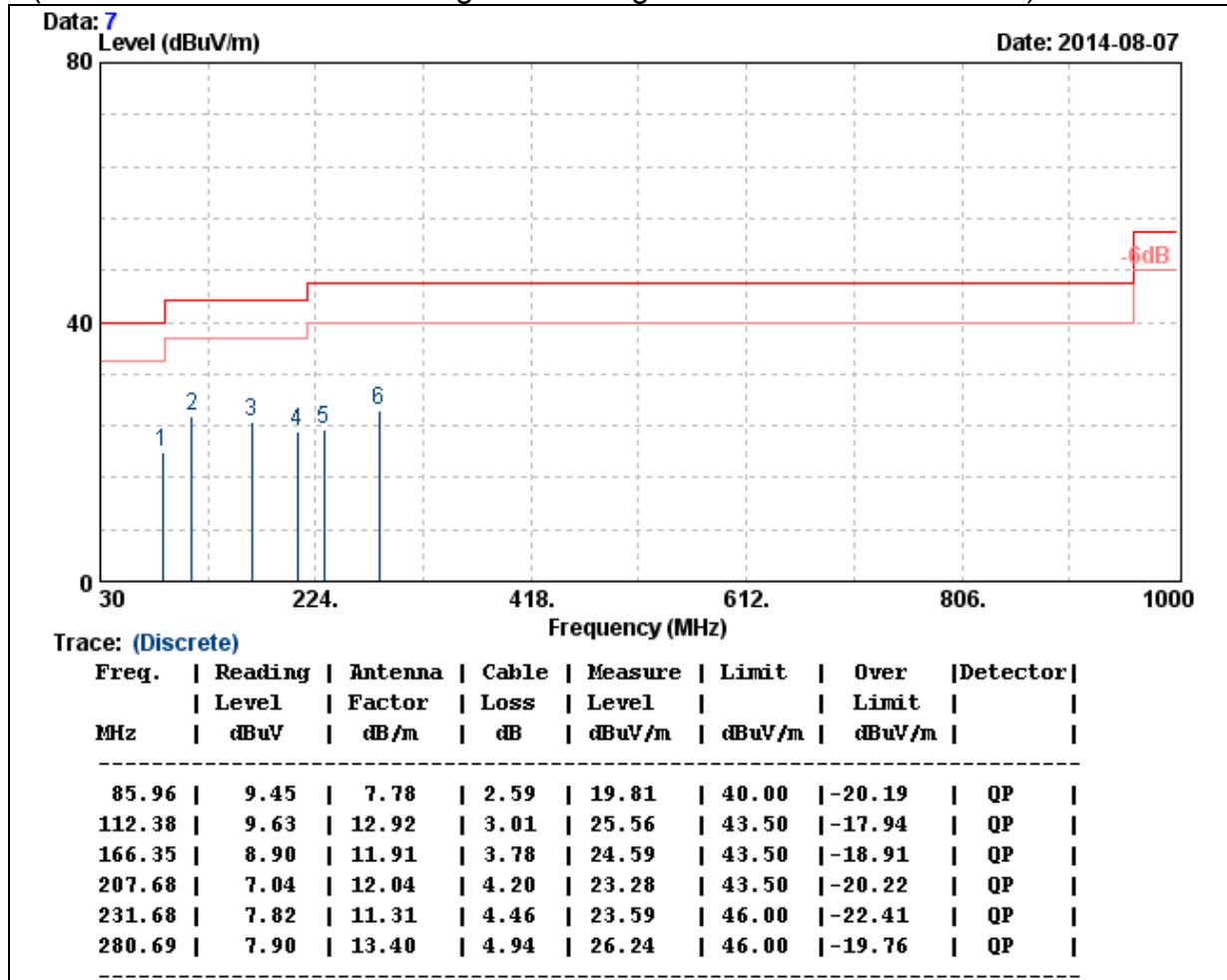
- Note: 1. QP= Quasi-peak Reading.
2. The other emission levels were very low against the limit



Product Name	Smart Handle	Test Date	2014/06/21
Model	ZSH	Test By	Taiyu Cyu
Test Mode	Charge mode / Worst case	TEMP& Humidity	27°C, 44%

Horizontal

(The chart below shows the highest readings taken from the final data.)



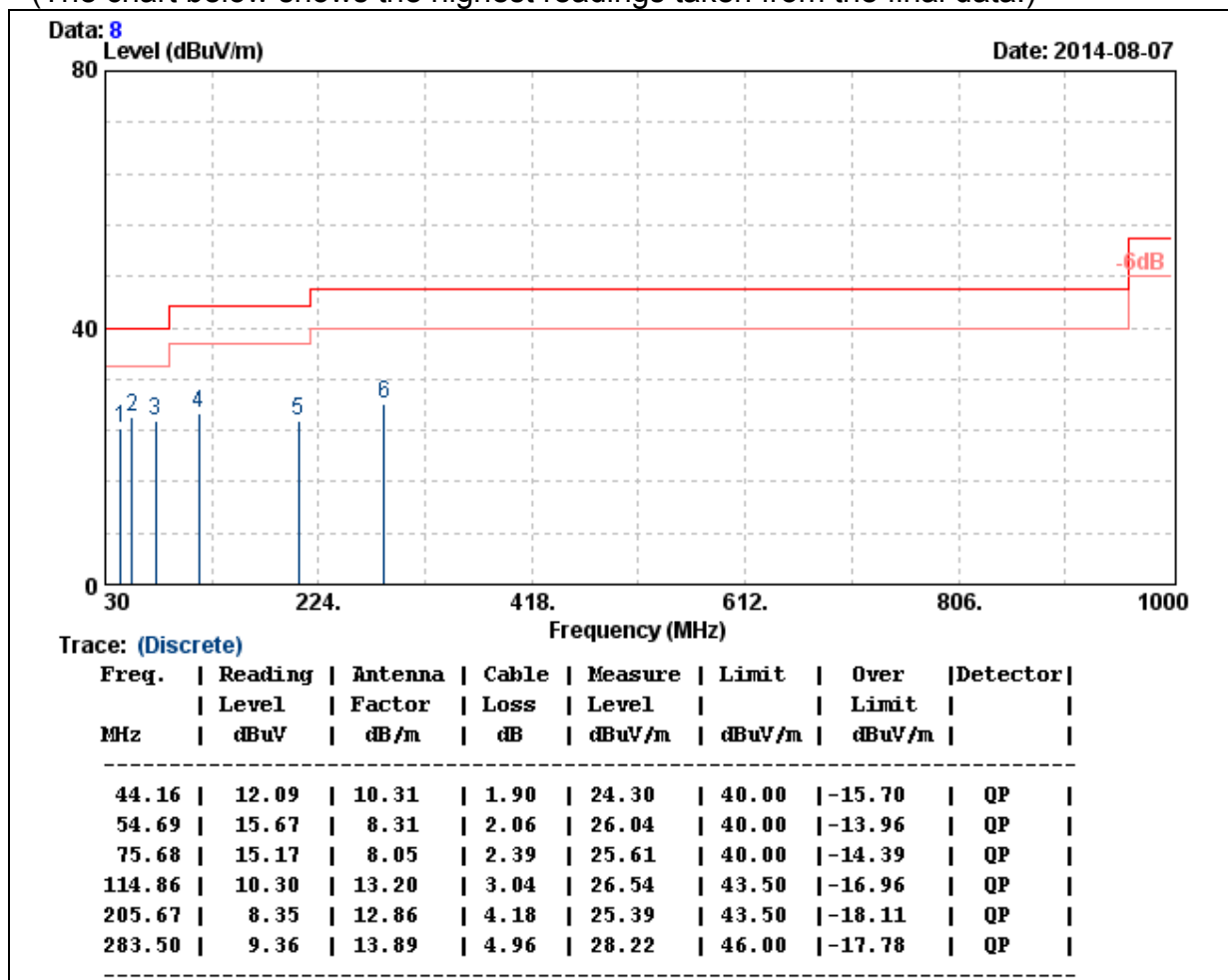
- Note: 1. QP= Quasi-peak Reading.
2. The other emission levels were very low against the limit



Product Name	Smart Handle	Test Date	2014/06/21
Model	ZSH	Test By	Taiyu Cyu
Test Mode	Charge mode / Worst case	TEMP& Humidity	27°C, 44%

Vertical

(The chart below shows the highest readings taken from the final data.)



- Note: 1. QP= Quasi-peak Reading.
2. The other emission levels were very low against the limit

**8.7.3 TRANSMITTER RADIATED EMISSION ABOVE 1 GHz**

Product Name	Smart Handle	Test Date	2014/08/21
Model	ZSH	Test By	Ted Huang
Test Mode	DSSS TX (CH Low)	TEMP& Humidity	27.5°C, 54%

Horizontal

TX / DSSS mode / CH Low					Measurement Distance at 3m Horizontal polarity					
Freq.	Reading	AF	Cable Loss	Pre-am p	Filter	Level	Limit	Margin	Mark	
(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)	
* 1447.62	58.14	26.59	1.97	48.80	0.30	38.20	74.00	-35.80	P	
* 1447.62	47.68	26.59	1.97	48.80	0.30	27.74	54.00	-26.26	A	
* 4804.01	56.48	33.81	3.77	48.29	0.40	46.17	74.00	-27.83	P	
* 4804.01	47.06	33.81	3.77	48.29	0.40	36.75	54.00	-17.25	A	

Product Name	Smart Handle	Test Date	2014/08/21
Model	ZSH	Test By	Ted Huang
Test Mode	DSSS TX (CH Low)	TEMP& Humidity	27.5°C, 54%

Vertical

TX / DSSS mode / CH Low					Measurement Distance at 3m Vertical polarity					
Freq.	Reading	AF	Cable Loss	Pre-am p	Filter	Level	Limit	Margin	Mark	
(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)	
* 1148.44	59.14	25.39	1.71	48.98	0.30	37.57	74.00	-36.43	P	
* 1148.44	48.63	25.39	1.71	48.98	0.30	27.06	54.00	-26.94	A	
* 4804.05	58.07	33.81	3.77	48.29	0.40	47.76	74.00	-26.24	P	
* 4804.05	49.93	33.81	3.77	48.29	0.40	39.62	54.00	-14.38	A	

REMARK:

1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss
2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
3. The result basic equation calculation is as follow:
Level = Reading + AF + Cable – Preamp + Filter – Dist, Margin = Level-Limit
4. The other emission levels were 20dB below the limit
5. The test limit distance is 3M limit.



Product Name	Smart Handle	Test Date	2014/08/21
Model	ZSH	Test By	Ted Huang
Test Mode	DSSS TX (CH Middle)	TEMP& Humidity	27.5°C, 54%

Horizontal

	TX / DSSS mode / CH Middle				Measurement Distance at 3m			Horizontal polarity		
	Freq.	Reading	AF	Cable Loss	Pre-am p	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
*	1448.38	57.44	26.59	1.97	48.80	0.30	37.50	74.00	-36.50	P
*	1448.38	46.54	26.59	1.97	48.80	0.30	26.60	54.00	-27.40	A
*	4883.88	55.65	34.05	3.80	48.30	0.40	45.61	74.00	-28.39	P
*	4883.88	46.15	34.05	3.80	48.30	0.40	36.11	54.00	-17.89	A

Product Name	Smart Handle	Test Date	2014/08/21
Model	ZSH	Test By	Ted Huang
Test Mode	DSSS TX (CH Middle)	TEMP& Humidity	27.5°C, 54%

Vertical

	TX / DSSS mode / CH Middle				Measurement Distance at 3m				Vertical	polarity
	Freq.	Reading	AF	Cable Loss	Pre-am p	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
*	1447.65	58.49	26.59	1.97	48.80	0.30	38.55	74.00	-35.45	P
*	1447.65	47.96	26.59	1.97	48.80	0.30	28.02	54.00	-25.98	A
*	4884.02	55.50	34.05	3.80	48.30	0.40	45.46	74.00	-28.54	P
*	4884.02	47.67	34.05	3.80	48.30	0.40	37.63	54.00	-16.37	A

REMARK:

1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss
2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
3. The result basic equation calculation is as follow:
Level = Reading + AF + Cable – Preamp + Filter – Dist, Margin = Level-Limit
4. The other emission levels were 20dB below the limit
5. The test limit distance is 3M limit.



Product Name	Smart Handle	Test Date	2014/08/21
Model	ZSH	Test By	Ted Huang
Test Mode	DSSS TX (CH High)	TEMP& Humidity	27.5°C, 54%

Horizontal

TX / DSSS mode / CH High				Measurement Distance at 3m				Horizontal polarity		
Freq.	Reading	AF	Cable Loss	Pre-am p	Filter	Level	Limit	Margin	Mark	
(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)	
* 1147.70	58.70	25.39	1.71	48.98	0.30	37.12	74.00	-36.88	P	
* 1147.70	48.52	25.39	1.71	48.98	0.30	26.94	54.00	-27.06	A	
* 4960.13	55.01	34.28	3.83	48.30	0.40	45.23	74.00	-28.77	P	
* 4960.13	44.96	34.28	3.83	48.30	0.40	35.18	54.00	-18.82	A	

Product Name	Smart Handle	Test Date	2014/08/21
Model	ZSH	Test By	Ted Huang
Test Mode	DSSS TX (CH High)	TEMP& Humidity	27.5°C, 54%

Vertical

TX / DSSS mode / CH High				Measurement Distance at 3m				Vertical polarity		
Freq.	Reading	AF	Cable Loss	Pre-am p	Filter	Level	Limit	Margin	Mark	
(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)	
* 1448.03	59.10	26.59	1.97	48.80	0.30	39.16	74.00	-34.84	P	
* 1448.03	48.68	26.59	1.97	48.80	0.30	28.74	54.00	-25.26	A	
* 4959.94	57.88	34.28	3.83	48.30	0.40	48.09	74.00	-25.91	P	
* 4959.94	48.32	34.28	3.83	48.30	0.40	38.53	54.00	-15.47	A	

REMARK:

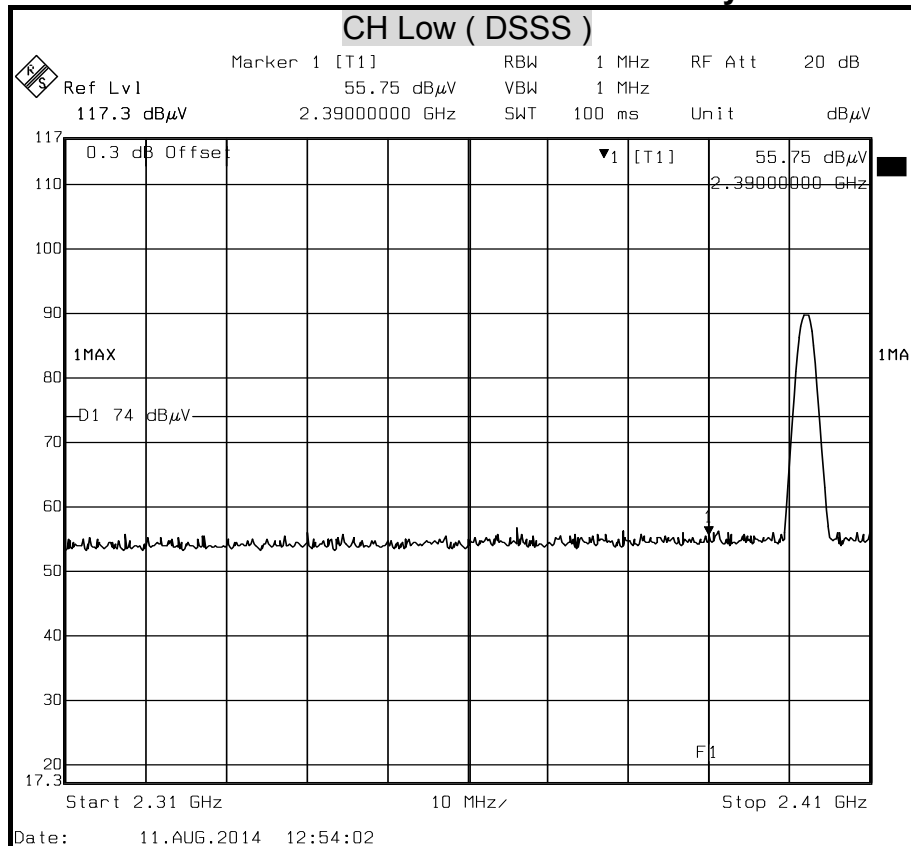
1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss
2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
3. The result basic equation calculation is as follow:
Level = Reading + AF + Cable – Preamp + Filter – Dist, Margin = Level-Limit
4. The other emission levels were 20dB below the limit
5. The test limit distance is 3M limit.



8.7.4 RESTRICTED BAND EDGES

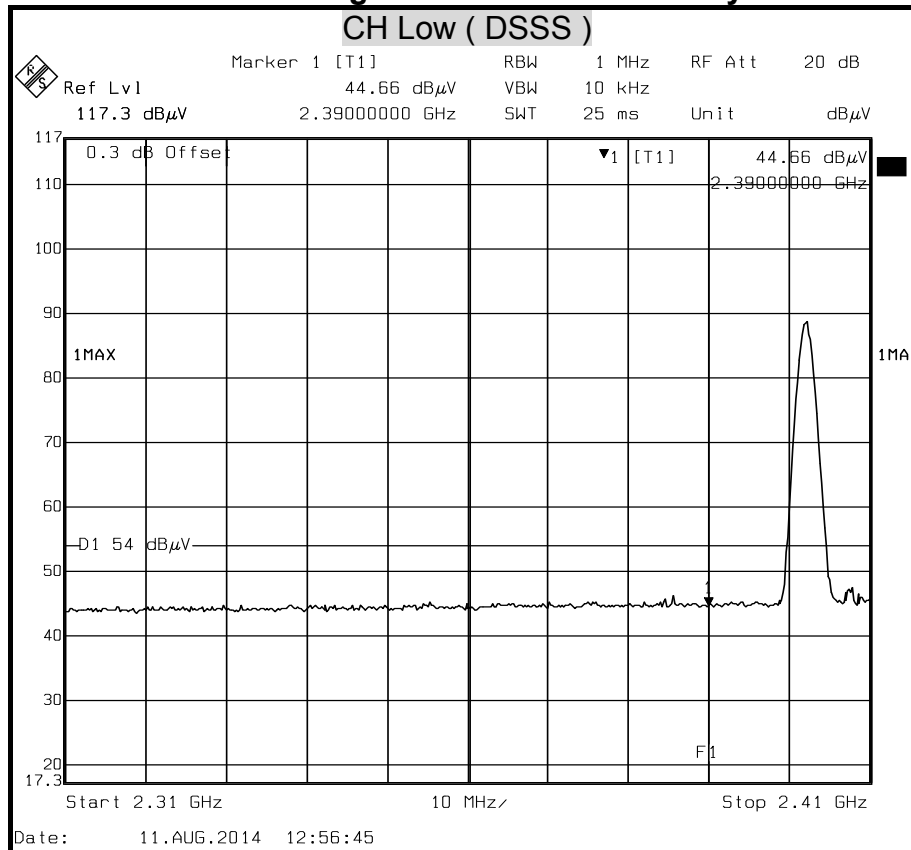
Detector Mode : Peak

Polarity : Horizontal



Detector Mode : Average

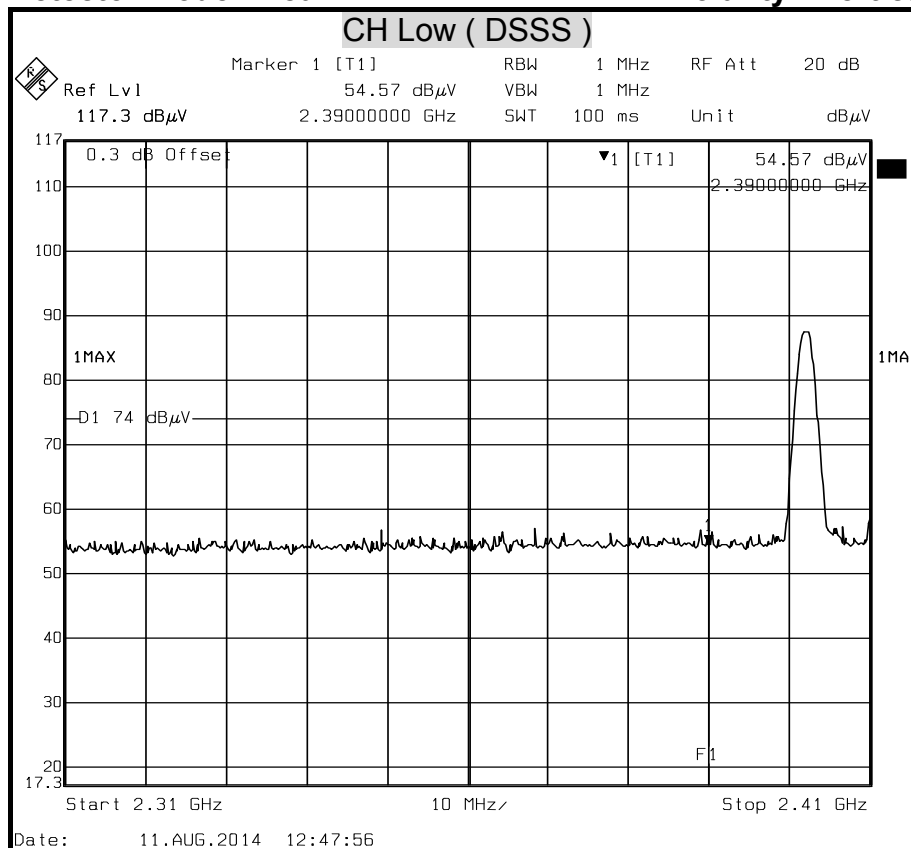
Polarity : Horizontal





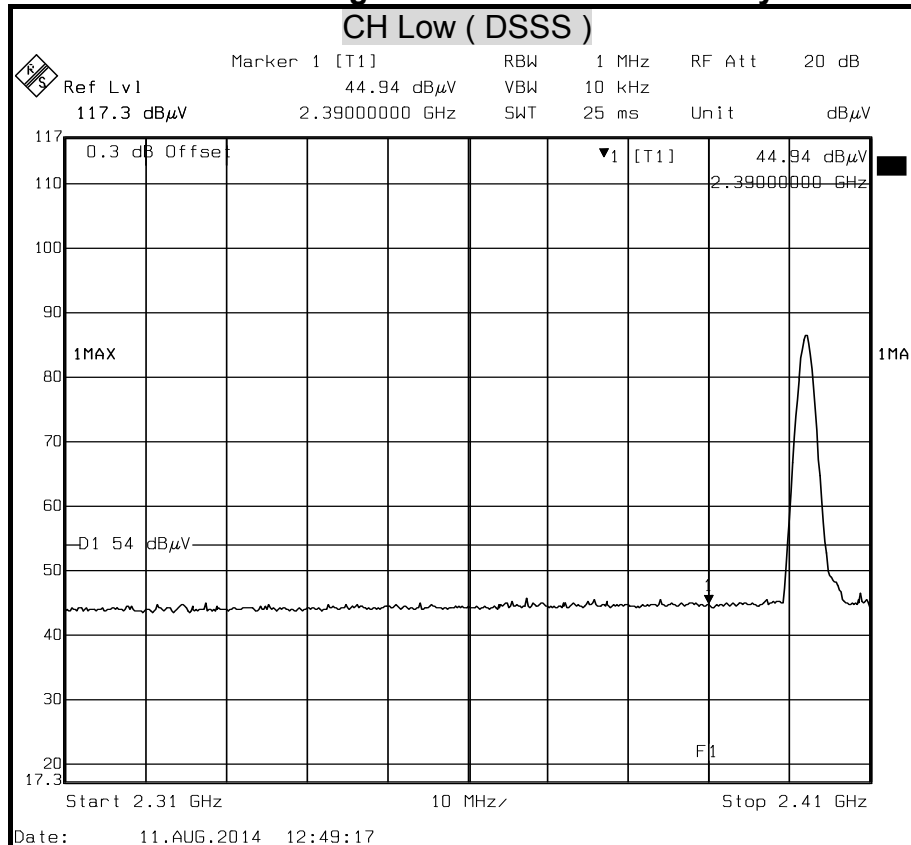
Detector Mode : Peak

Polarity : Vertical



Detector Mode : Average

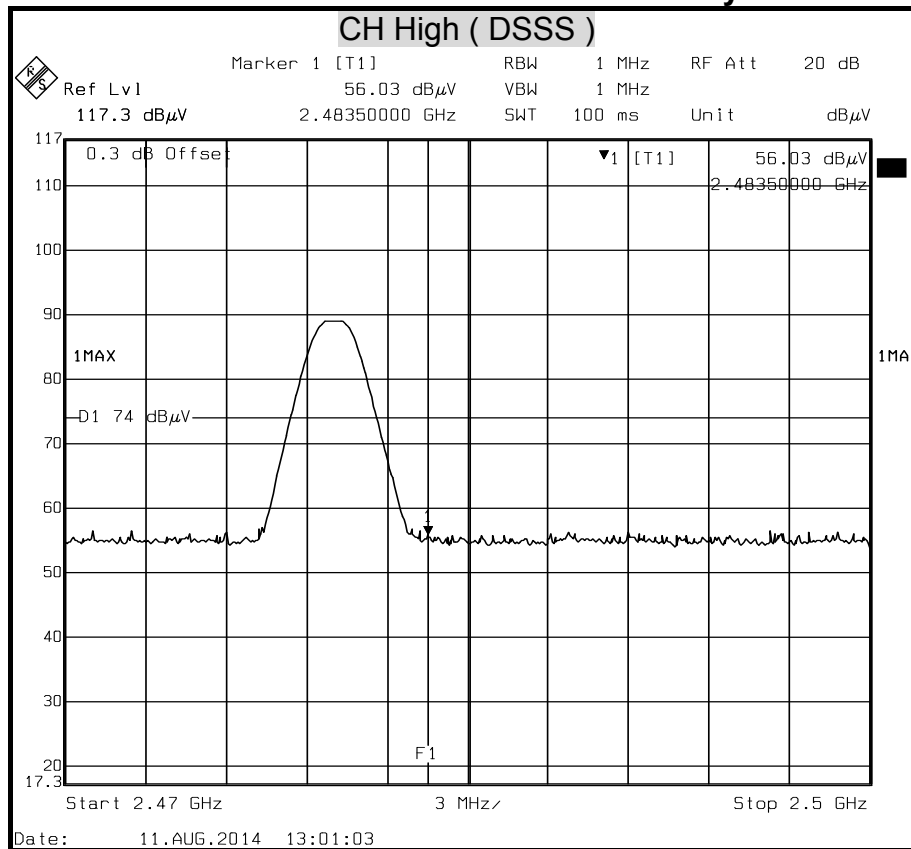
Polarity : Vertical





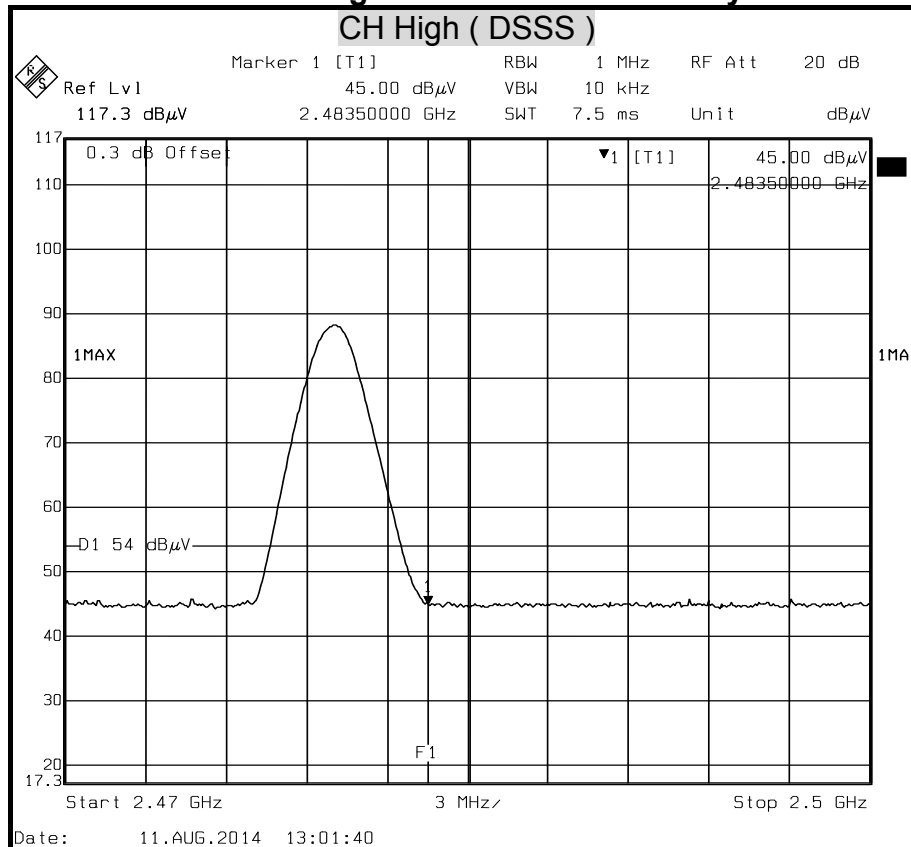
Detector Mode : Peak

Polarity : Horizontal



Detector Mode : Average

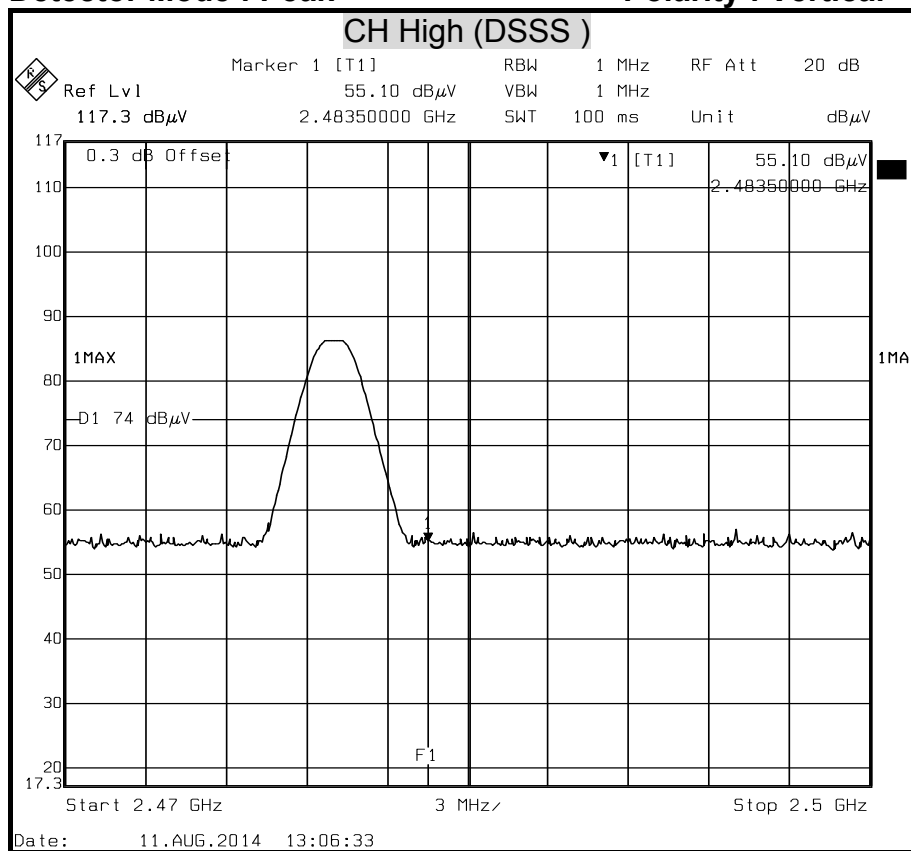
Polarity : Horizontal





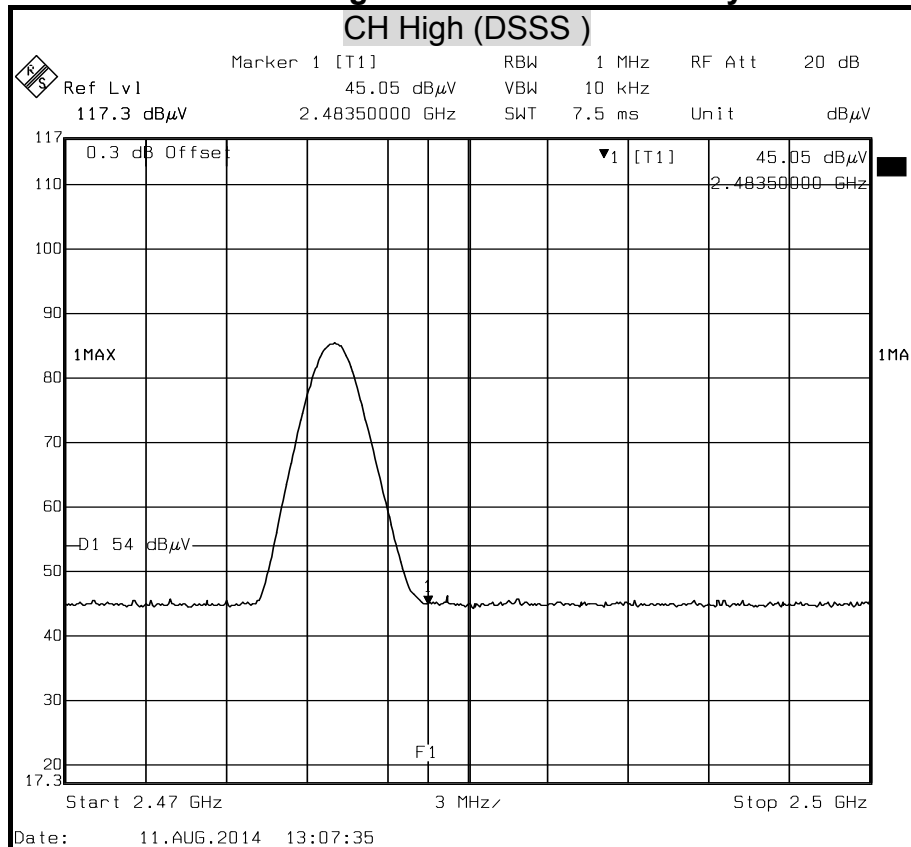
Detector Mode : Peak

Polarity : Vertical



Detector Mode : Average

Polarity : Vertical





8.8 POWERLINE CONDUCTED EMISSIONS

LIMITS

§ 15.207 (a) Except as shown in paragraph (b) and (c) this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

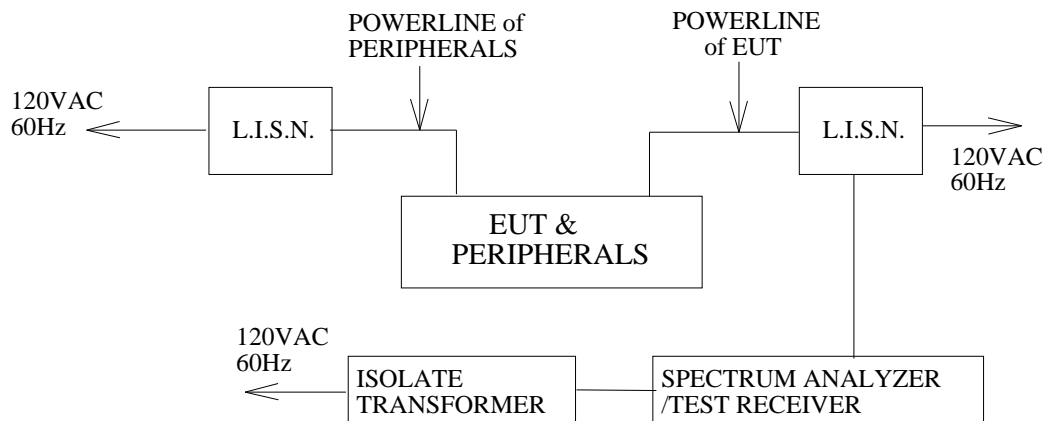
The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted limit (dB μ v)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56	56 to 46
0.5 - 5	56	46
5 - 30	60	50

TEST EQUIPMENTS

The following test equipments are used during the conducted power line tests :

Conducted Emission room #1				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
L.I.S.N.	SCHWARZBECK	NNLK 8130	8130124	AUG. 12, 2015
	Rohde & Schwarz	ESH 3-Z5	840062/021	SEP. 09, 2014
TEST RECEIVER	Rohde & Schwarz	ESH 3-Z5	893540/015	APR. 13, 2015
TYPE N COAXIAL CABLE	Rohde & Schwarz	ESCS 30	100348	AUG. 09, 2015
Test S/W	e-3 (5.04211c) R&S (2.27)			

**TEST SETUP****TEST PROCEDURE**

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80cm above the horizontal ground plane. The EUT IS CONFIGURED IN ACCORDANCE WITH ANSI C63.4.

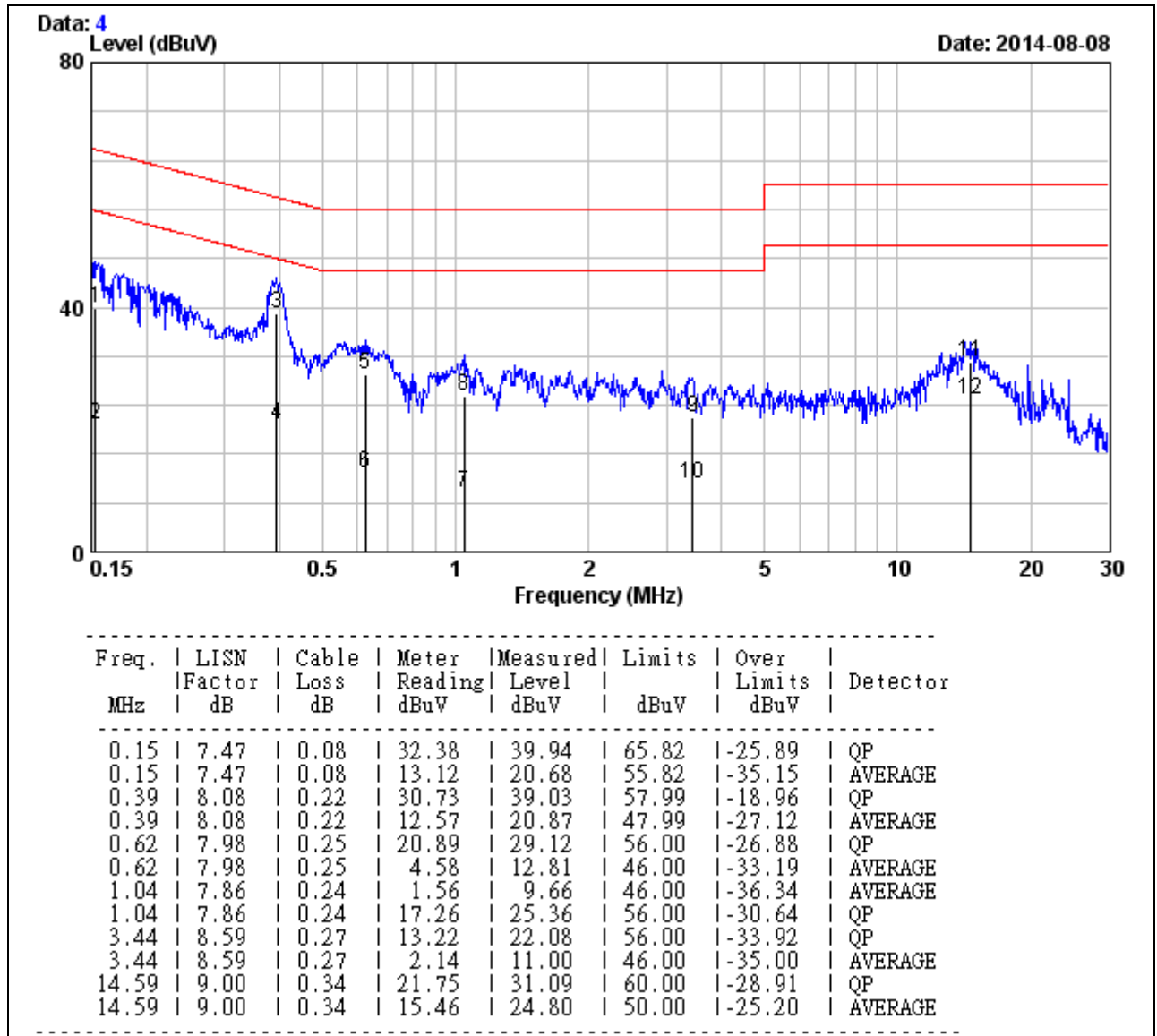
The resolution bandwidth is set to 9 kHz for both quasi-peak detection and average detection measurements.

Line conducted data is recorded for both NEUTRAL and LINE.

**TEST RESULTS**

No non-compliance noted.

Product Name	Smart Handle	Test Date	2014/08/08
Model Name	ZSH	Test By	Vis Liang
Test Mode	Charge mode	Temp & Humidity	24.5°C, 55%

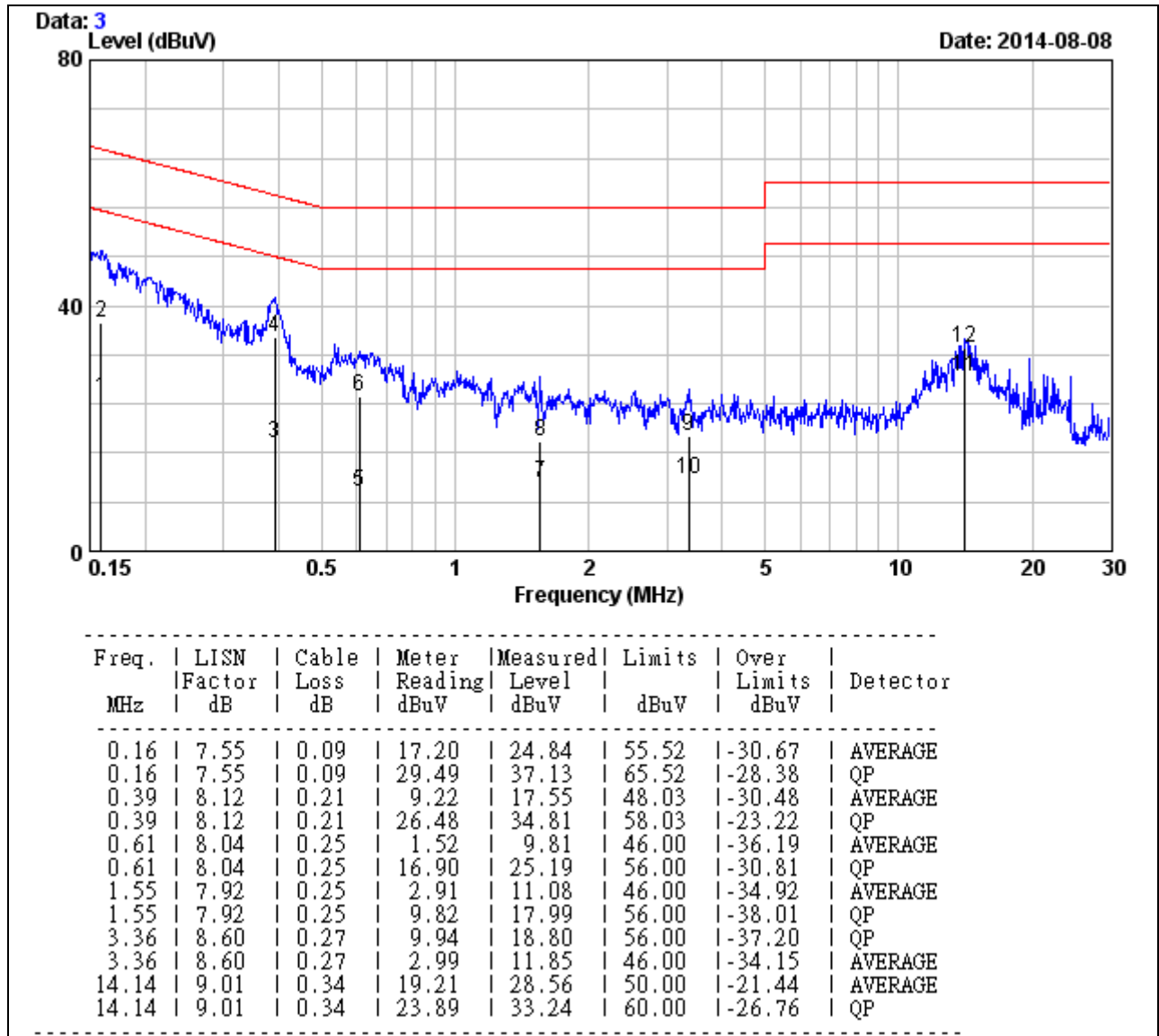
LINE**Remark:**

1. Correction Factor = Insertion loss + Cable loss
2. Emission level = Reading Value + Correction factor
3. Margin value = Emission level – Limit value



Product Name	Smart Handle	Test Date	2014/08/08
Model Name	ZSH	Test By	Vis Liang
Test Mode	Charge mode	Temp & Humidity	24.5°C, 55%

NEUTRAL



Remark:

1. Correction Factor = Insertion loss + Cable loss
2. Emission level = Reading Value + Correction factor
3. Margin value = Emission level – Limit value



9. ANTENNA REQUIREMENT

9.1 STANDARD APPLICABLE

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

9.2 ANTENNA CONNECTED CONSTRUCTION

Type: Dipole
Model: WMT08410-A
Brand: ZMI
Gain: -5.64dBi