



TEST REPORT

Number 15-001567-01-01

According to
FCC CFR 47 Part 22(H), Part 24(E)

For

Applicant	Suntech International Ltd.
Manufacturer	Suntech International Ltd.
Model or Type	ST600 WCDMA Vehicle Tracker
Final H/W Version	ST600_Rev01
Final S/W Version	ST600_STGPS_305

Issue To: Suntech International Ltd B-1506, Greatvally, 32, 9-Gil, Digital-Ro, Geumcheon-Gu, Seoul, KOREA	Date of Application	2015-01-09
	Date of Report	2015-02-09
	Date of Issue	2015-02-09

This Test Report consists of 29 pages

The above test certificate is the accredited test results by Korea Laboratory Accreditation Scheme, which signed the ILAC-MRA

Korea Testing Laboratory

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Test Report revision History

Revision	Date	Comments
01	2015-02-09	Initial Version

Signature

This Test Report is issued under the authority as below

Date : 09 February, 2015

Test Engineer : Jong-gon Ban



Reviewed/Approved by : Jang tae-heon



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1. GENERAL INFORMATION

1.1. Applicant (Client)

Name	Suntech International Ltd.
Address	B-1506, Greatvally, 32, 9-Gil, Digital-Ro, Geumcheon-Gu, Seoul, KOREA
Contact Person	Yohan Kim
Telephone No.	+82-2-6327-5661
Facsimile No.	-
E-mail address	yhkim@suntechint.com
Manufacturer Name	Suntech International Ltd.
Manufacturer Address	B-1506, Greatvally, 32, 9-Gil, Digital-Ro, Geumcheon-Gu, Seoul, KOREA

1.2. Equipment (EUT)

Type of equipment	Dual band WCDMA Vehicle Tracker
Model Name	ST600
FCC ID	WA2ST600
FCC Classification	PCS Licensed Transmitter (PCB)
Tx frequency Band	(826.4 ~ 846.6) MHz (WCDMA Band 5) (1 852.4 ~ 1 907.6) MHz (WCDMA Band 2)
Rx frequency Band	(871.4 ~ 891.6) MHz (WCDMA Band 5) (1 932.4 ~ 1 987.6) MHz (WCDMA Band 2)
Max. Power Rating	21.18 dBm (WCDMA Band 2) / 22.32 dBm (WCDMA Band 5)
MODE	WCDMA (HSPA)
Antenna Type	Internal Antenna Band2 Peak Gain : 2 dBi / Band5 Peak Gain : -1 dBi
Power class	Class 3
Hardware Version	ST600_Rev01
Software Version	ST600_STGPS_305

1.3. Testing Laboratory

Testing Place	Korea Testing Laboratory (KTL) 1271-12, Sa-Dong Sangnok-Gu, Ansan-si Gyunggi-Do , Korea
FCC registration number	408324
Industry Canada filing number	6298
Test Engineer	Jong-gon, Ban
Telephone number	+82 31 5000 133
Facsimile number	+82 31 5000 149
E-mail address	banjg@ktl.re.kr
Other Comments	-

1.4. Description of test mode

Band	Frequency (MHz)	Average Output Power (dBm)
WCDMA Band 2	1 852.4	21.18
	1 880.0	20.91
	1 907.0	20.90

Band	Frequency (MHz)	Average Output Power (dBm)
WCDMA Band 5	826.4	22.32
	836.6	21.96
	846.6	21.95

* The UMTS output powers were measured according to the test requirements outlined in section 5.2 of 3GPP TS34.121-1. And WCDMA RMC 12.2 kbps mode was found as the worst power mode as above.

2. SUMMARY OF TEST RESULTS

Testing performed for : Suntech International Ltd.

Equipment Under Test : ST600

Receipt of Test Sample : 2015. 01. 09.

Test Start Date : 2015. 01. 09.

Test End Date : 2015. 01. 16.

The following table represents the list of measurements required under the FCC CFR47 Part 22H and 24E.

FCC Rules	Test Requirements	Result
22.913(a), 24.232(c)	Conducted RF power output	Pass
22.913(a), 24.232(c)	ERP & EIRP	Pass
22.917, 24.238	Radiated Spurious Emission	Pass
2.1049	Occupied bandwidth	Pass
22.917, 24.238	Conducted Spurious Emission	Pass
22.355, 24.235	Frequency Stability	Pass

Note 1 : Test results reported in this document relate only to the items tested

Note 2 : The required tests demonstrated compliance as per client declaration of test configuration, monitoring methodology and associated pass/fail criteria

Note 3 : Test results apply only to the item(s) tested

*** Modifications required for compliance**

No modifications were implemented by KTL.

All results in this report pertain to the un-modified sample provided to KTL.

3. Measurement & Results

3.1. Conducted Output Power

3.1.1. Test Procedure

A base station simulator (CMU200) was used to establish communication with the EUT. The base station simulator parameters were set to produce the maximum power from the EUT. Conducted Output Powers of EUT are reported below.

3.1.2. Test Results

Mode	Frequency (MHz)	Average Output Power (dBm)
WCDMA Band 2	1 852.4	21.18
	1 880	20.91
	1 907.6	20.90

Mode	Frequency (MHz)	Average Output Power (dBm)
WCDMA Band 5	826.4	22.32
	836.6	21.96
	846.6	21.95

The UMTS output powers were measured according to the test requirements outlined in section 5.2 of 3GPP TS34.121-1. And WCDMA RMC 12.2 kbps mode was found as the worst power mode as above.

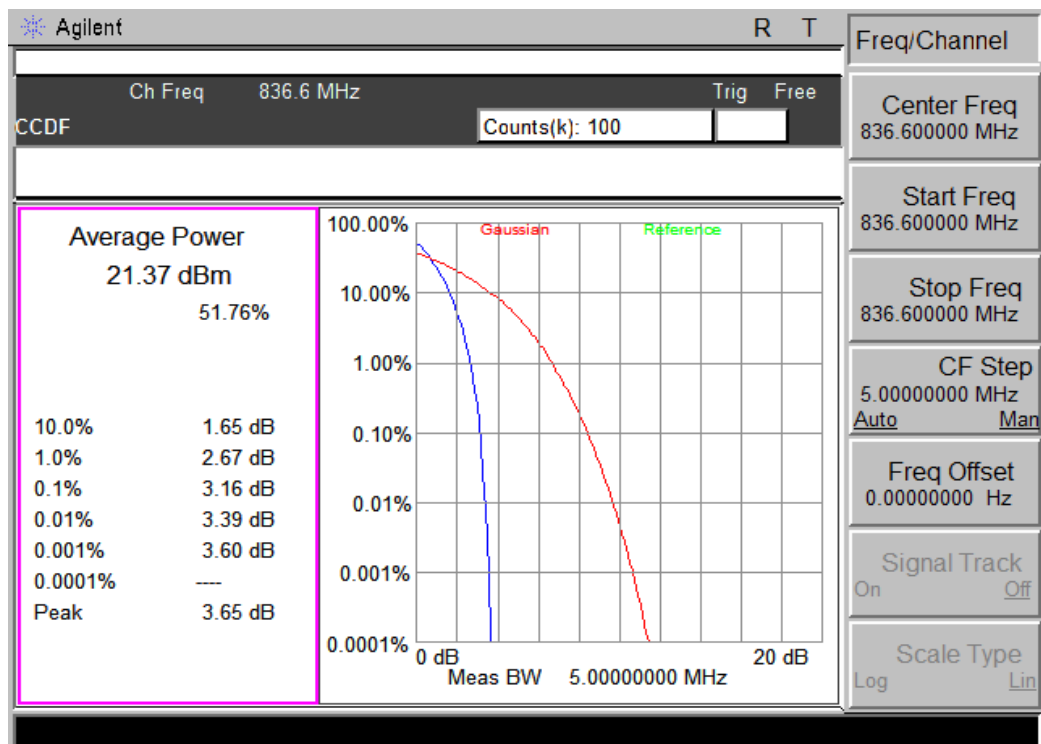
3.2. Peak To Average Ratio

3.2.1. Test Procedure

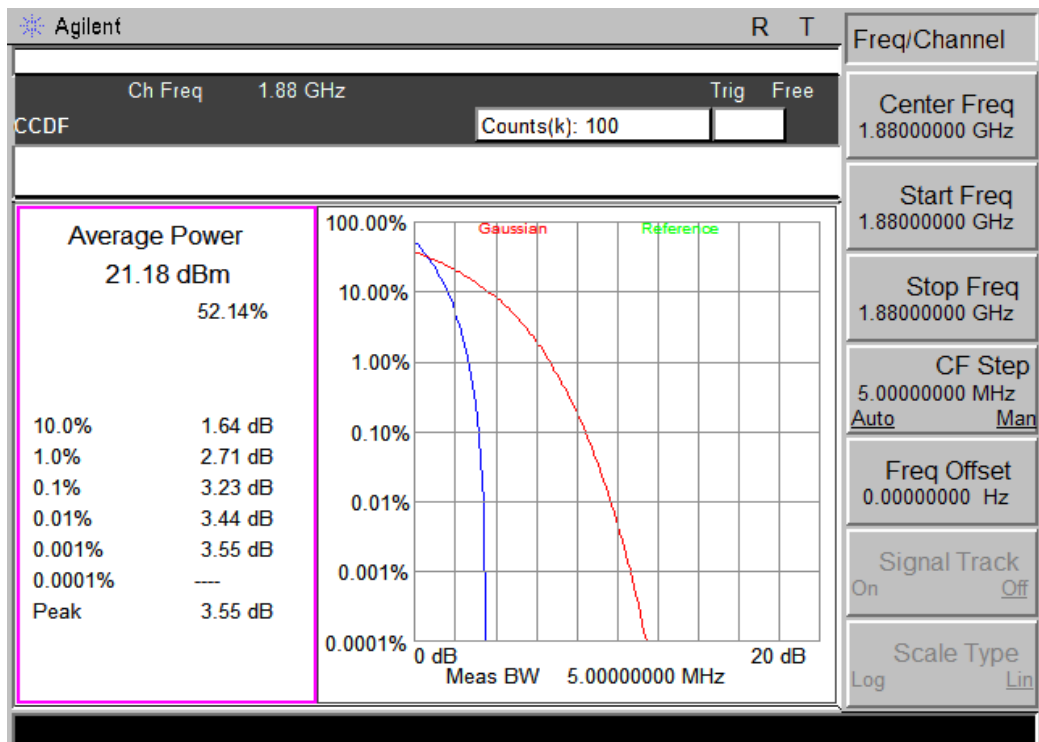
Per KDB 971168 D01 Power Meas License Digital Systems v02r02

3.2.2. Limit

The peak-to-average ratio of the power shall not exceed 13 dB.



– WCDMA Band 5 –



– WCDMA Band 2 –

3.3. Effective Radiated Power

3.3.1. Test Procedure

The radiated and spurious measurements were made Fully-anechoic chamber at a 3-meter test range. The EUT was placed on the rotating device at 1.5m and at a distance of 3-meters from the receive antenna. The rotating device which can rotate horizontal axis was mounted on the turn unit to facilitate rotation around a vertical axis. The measurement was made for each horizontal/vertical position combination with receive antenna horizontally polarized. This measurement was repeated with receive antenna vertically polarized. The substitution antenna will replace the EUT antenna it the same position and in vertical polarization. The frequency of the signal generator shall be set to the frequencies that were measured on the EUT. The signal generator, output level, shall be adjusted until an equal or a known related level to what was measured from the EUT is obtained in the spectrum analyzer. This level was recorded. For readings above 1 GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic antenna are taken into consideration.

All modes of operation were investigated, and the worst-case results are reported.

3.3.2. Limit

FCC 22.913(b) : The Effective Radiated Power (ERP) of mobile transmitters must not exceed 7 Watts.

FCC 24.232(b) : The equivalent Isotropic Radiated Power (EIRP) must not exceed 2 Watts.

3.3.3. ERP Sample Calculation

Frequency(M Hz)	Measured Level [dBm]	Substitute Level(dBm)	Ant Gain (dBd)	Cable Loss (dB)	Polarization [H/V]	ERP [dBm]
836.6	-37.69	16.83	-0.54	1.09	H	18.46

$$\begin{aligned} \text{ERP} &= \text{Substitute Level (dBm)} - \text{Ant. Gain} - \text{Cable Loss} \\ &= 16.83 - (-0.54) + 1.09 = 18.46 \text{ dBm} \end{aligned}$$

3.3.4. Test Result

- WCDMA Band 2 Test Data

Frequency (MHz)	Measured Level [dBm]	Substitute Level(dBm)	Ant Gain (dBd)	Cable Loss (dB)	Polarization [H/V]	EIRP [dBm]
1852.4	-39.07	21.65	4	1.58	H	19.23
1880.0	-40.54	20.29	4.06	1.62	H	17.85
1907.6	-39.68	21.29	4.07	1.65	H	18.87

- WCDMA Band 5 Test Data

Frequency (MHz)	Measured Level [dBm]	Substitute Level(dBm)	Ant Gain (dBi)	Cable Loss (dB)	Polarization [H/V]	ERP [dBm]
826.4	-40.79	14.91	-0.48	1.05	H	16.44
836.6	-37.69	16.83	-0.54	1.09	H	18.46
846.6	-36.98	17.24	-0.62	1.11	H	18.97

3.4. Radiated Spurious Emissions

3.4.1. Test Procedure

Radiated spurious emissions measurements are performed using the substitution method described in ANSI/TIA-603-C-2004 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using horizontally and vertically polarized tuned dipole antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as peak measurements while the EUT is operating at maximum power, and at the appropriate frequencies.

KDB 971168 v02r02 – Section 5.8

ANSI/TIA-603-C-2004 – Section 2.2.12

Test Settings

1. RBW = 100 kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW $\geq 3 \times$ RBW
3. Span = 1.5 times the OBW
4. No. of sweep points $\geq 2 \times$ span / RBW
5. Detector = Peak
6. Trace mode = max hold
7. The trace was allowed to stabilize

3.4.2. Radiated Spurious Emissions (Band 2)

FCC 22.917(a) & 24.238(a) : The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10\log(P)$ dB.

- Measured Output Power : 19.23 dBm = 0.084 W
- Mode : WCDMA Band 2
- Distance : 3 meters
- LIMIT : $43 + 10\log_{10}(W)$: 32.24 dBc

Frequency (MHz)	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	E.I.R.P [dBm]	Polarization [H/V]	dBc
Operating Frequency : 1 852.6 MHz (9 262CH)					
3 707.2	-68.75	12.31	-56.44	H	-75.67
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
Operating Frequency : 1 880.0 MHz (9 400CH)					
3755.6	-71.93	12.29	-59.64	H	-78.87
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
Operating Frequency : 1 907.4 MHz (9 538CH)					
3 812.8	-68.57	12.38	-56.19	H	-75.42
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

3.4.3. Radiated Spurious Emissions (Band 5)

FCC 22.917(a) & 24.238(a) : The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10\log(P)$ dB.

- Measured Output Power : 18.97 dBm = 0.079 W
- Mode : WCDMA Band 5
- Distance : 3 meters
- LIMIT : $43 + 10\log_{10}(W)$: 31.97 dBc

Frequency (MHz)	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	E.I.R.P [dBm]	Polarization [H/V]	dBc
Operating Frequency : 826.6 MHz (4 132CH)					
1650.8	-56.52	8.51	-48.01	H	-66.98
2481.8	-63.19	10.35	-52.84	V	-71.81
Operating Frequency : 1880.0 MHz (661CH)					
1671.6	-56.02	8.53	-47.49	H	-66.46
2481.8	-63.21	10.37	-52.84	V	-71.81
Operating Frequency : 1909.8 MHz (810CH)					
1694.8	-57.56	8.99	-48.57	H	-67.54
2541.8	-61.69	10.39	-51.30	V	-70.27

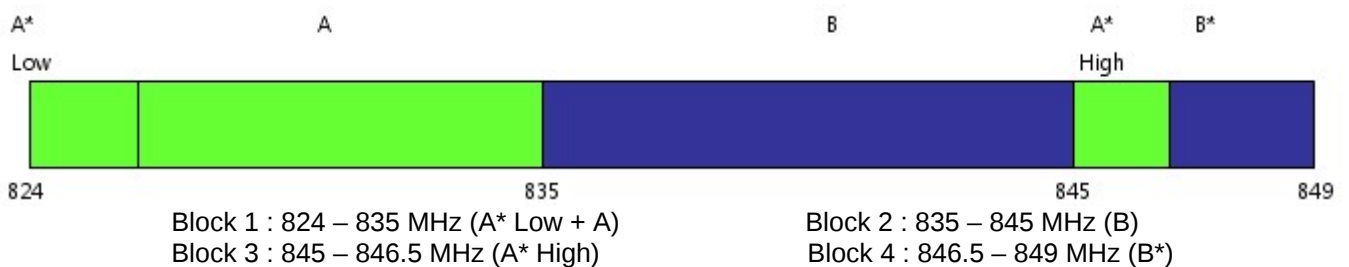
3.5. Occupied Bandwidth

3.5.1. Test Procedure

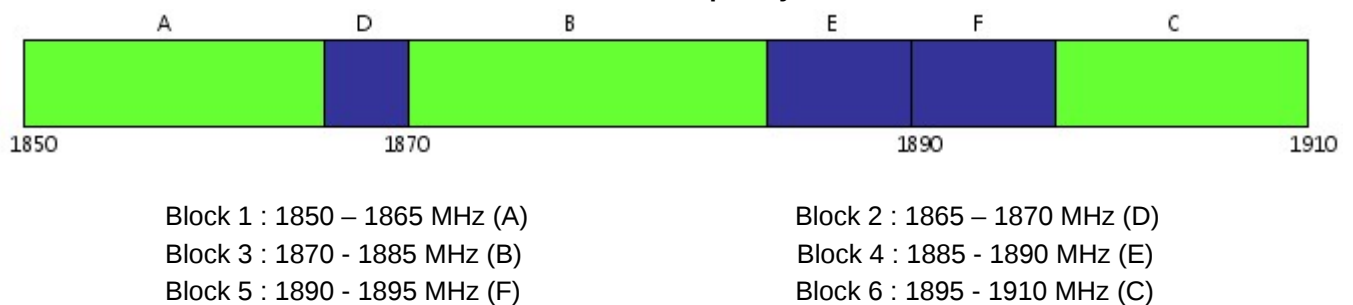
The EUT's output RF connector was connected with a short cable to spectrum analyzer. The EUT was setup to maximum output power. The EUT's occupied bandwidth is measured as the width of the signal between two points, one below the carrier center frequency and one above the carrier frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power. RBW was set to about 1% of emission BW, VBW is set to 3 times.

3.5.2. Limit

- On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log(P)$ dB
- Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB Below the transmitter power.
- When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the license's frequency block edges, both upper and lower, as the design permits.
- The measurement of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.



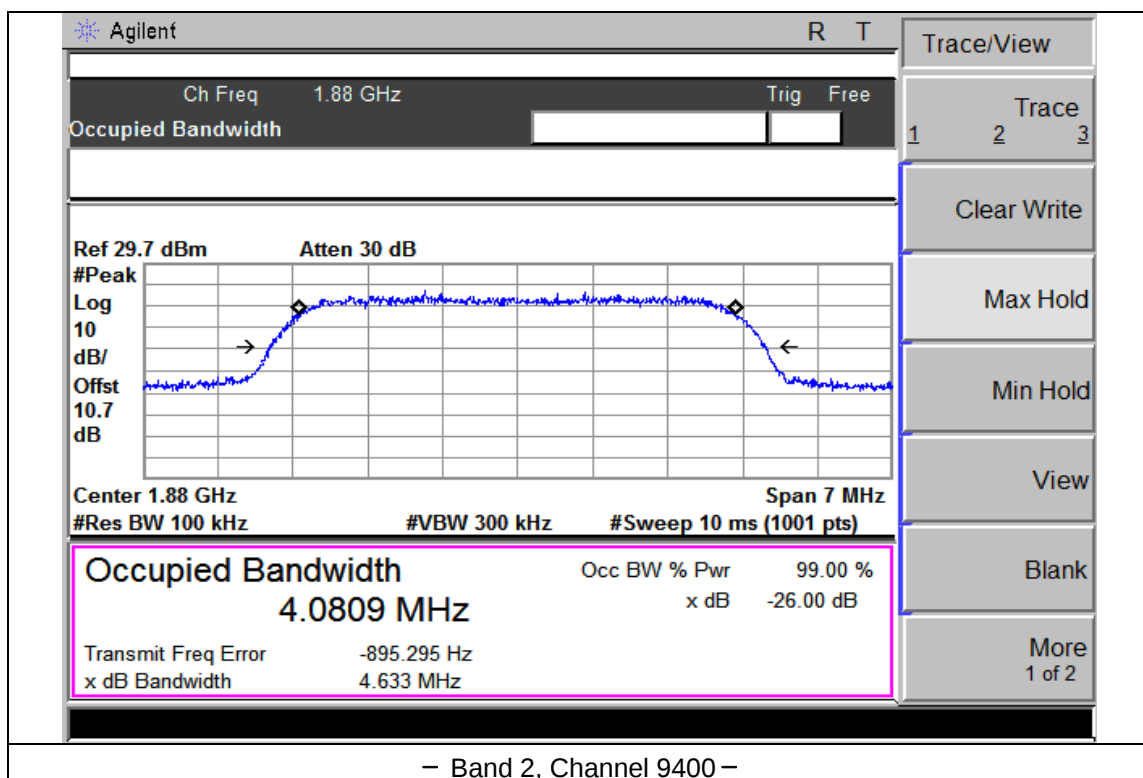
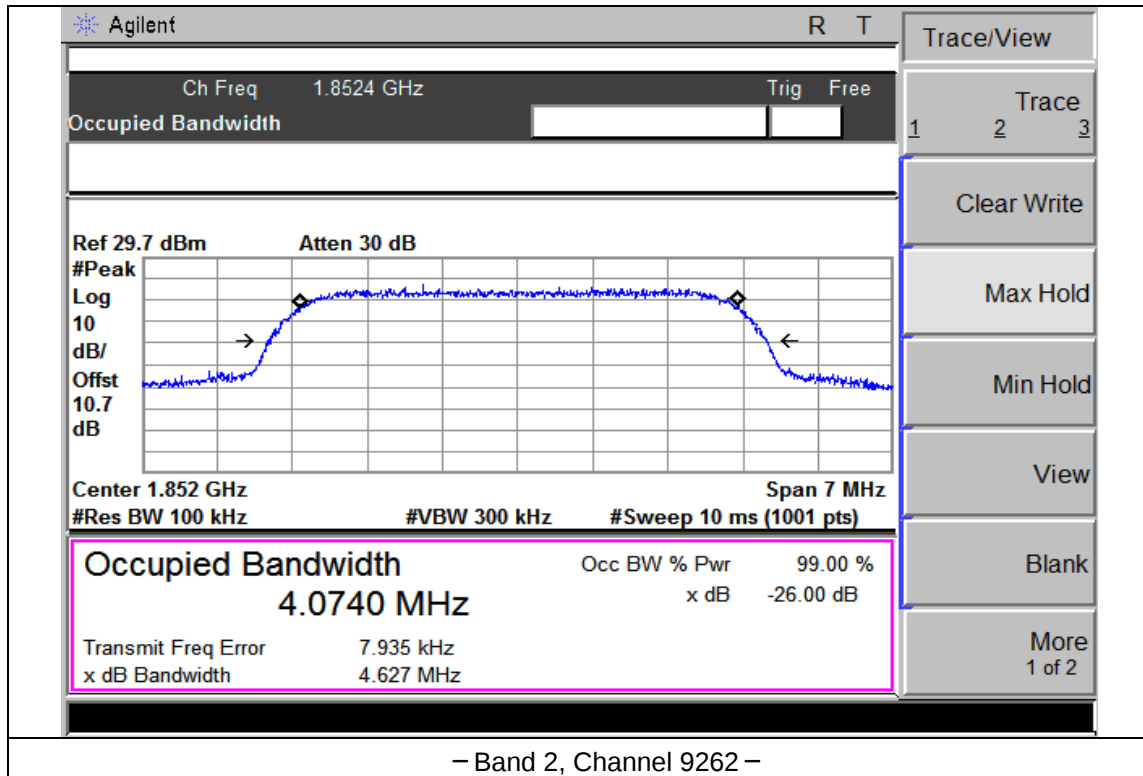
- Cellular Service Frequency Blocks -

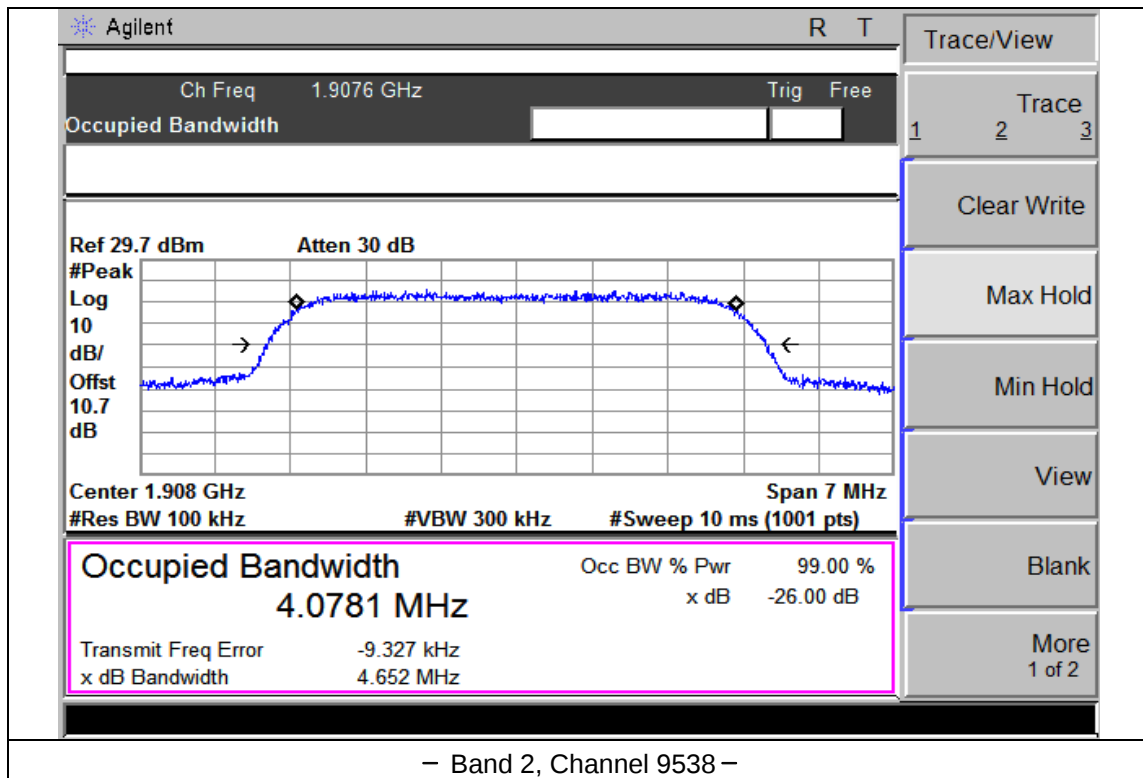


- Broadband PCS Service Frequency Blocks -

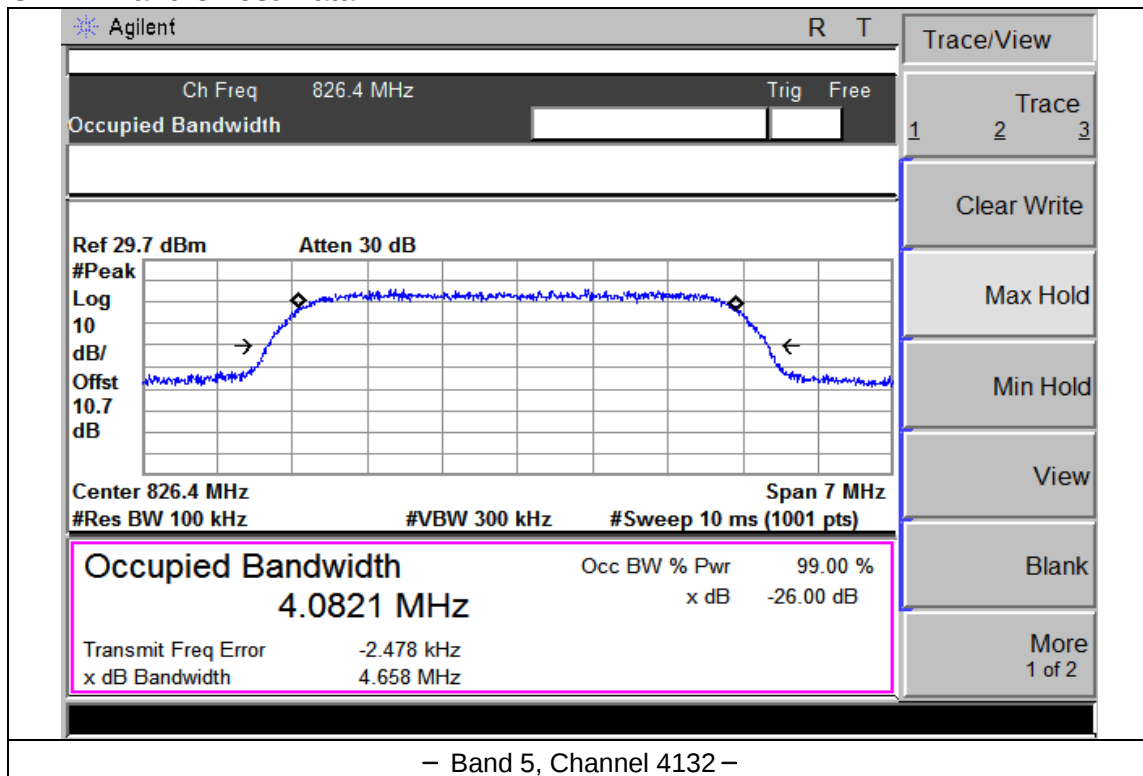
3.5.3. Test Results

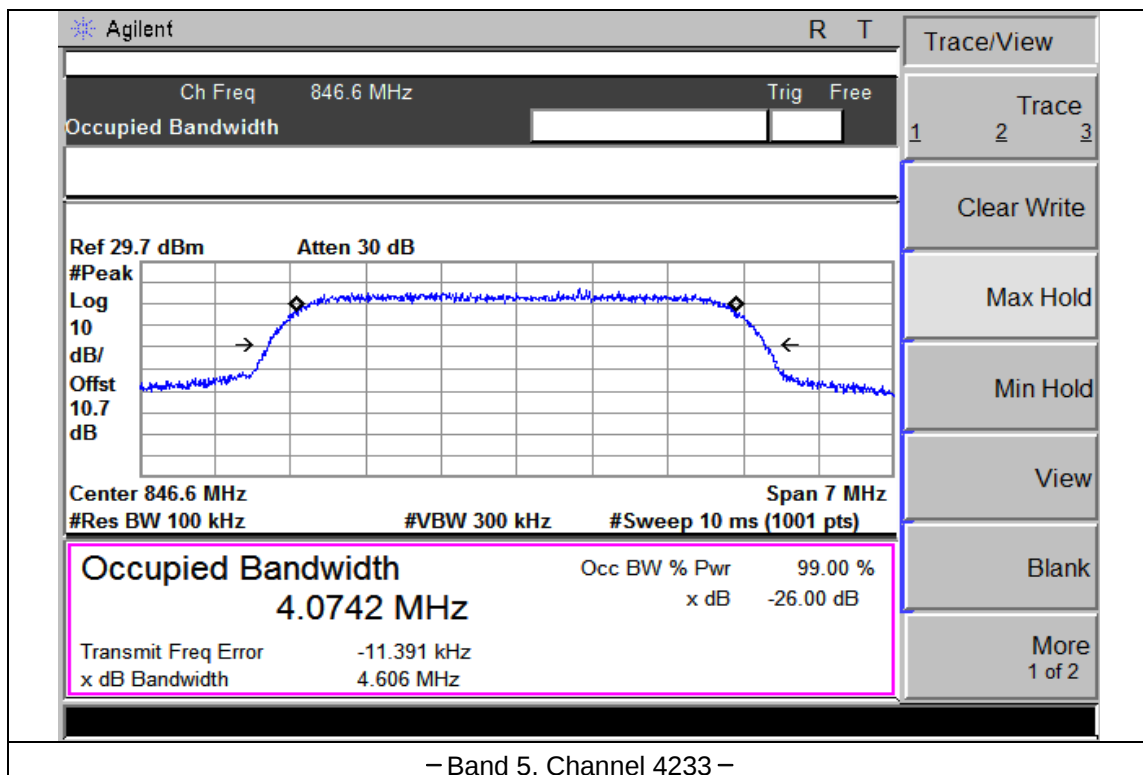
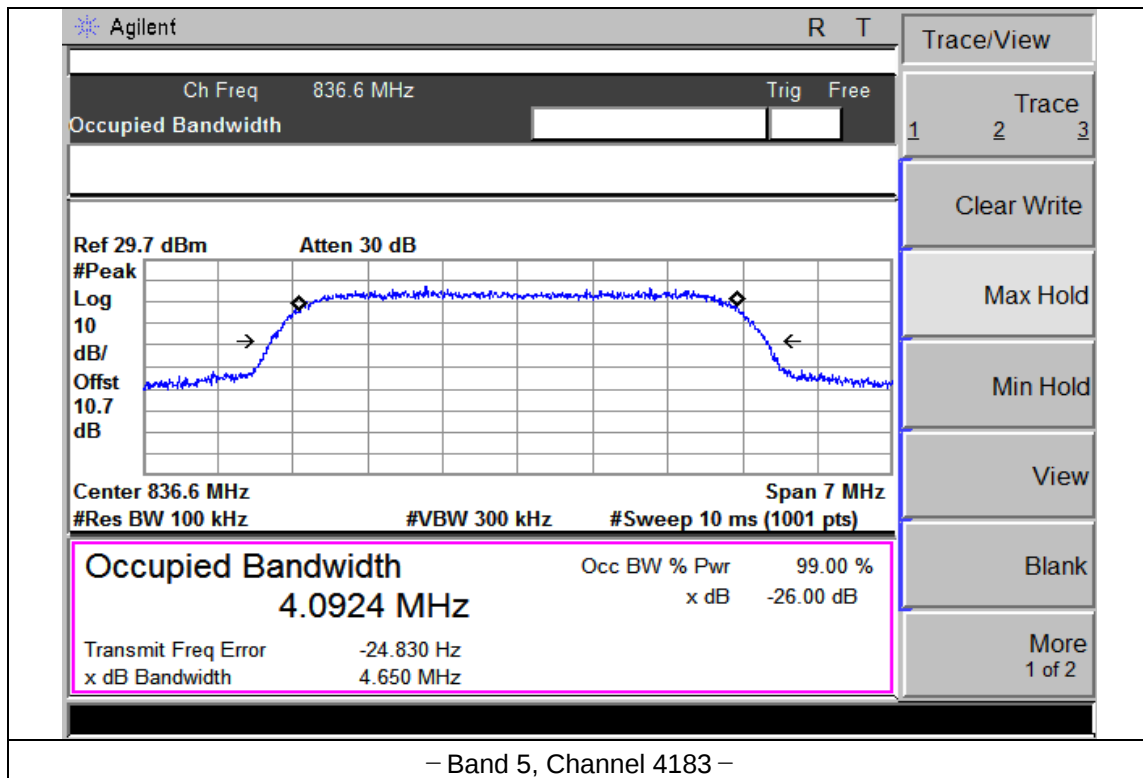
- WCDMA Band 2 Test Data





• WCDMA Band 5 Test Data





3.6. Conducted Spurious Emission

3.6.1. Test Procedure

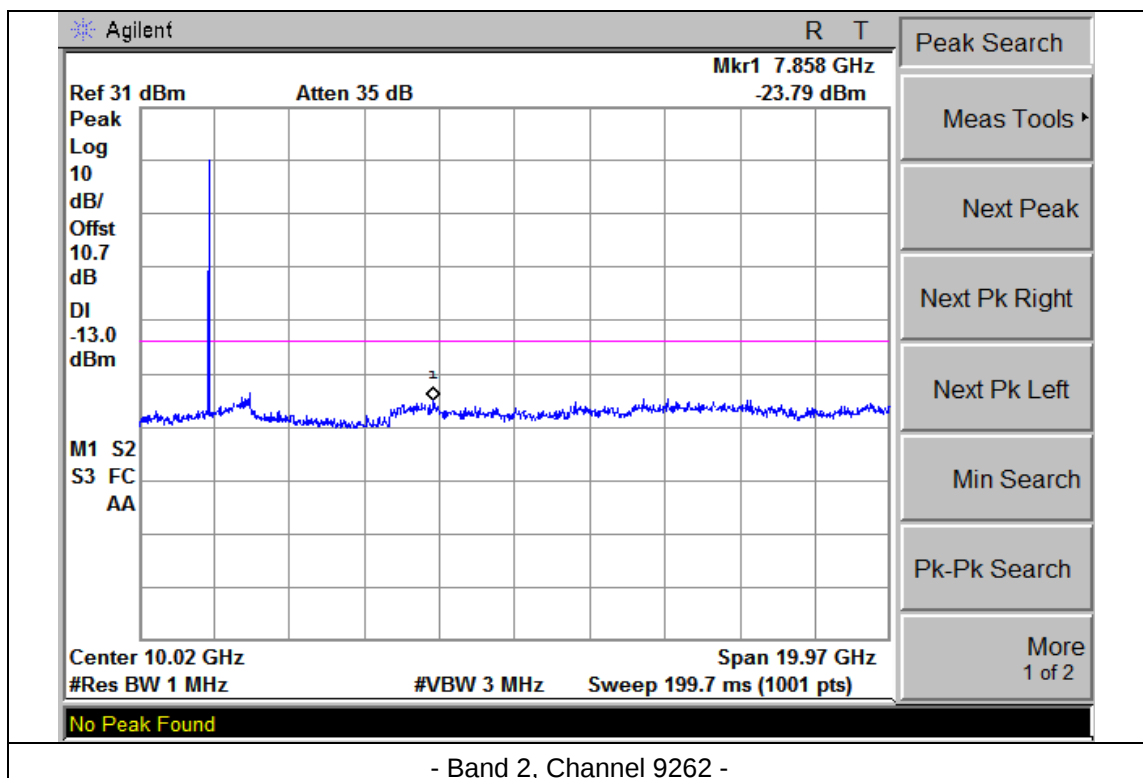
The EUT's output RF connector was connected with a short cable to spectrum analyzer. The EUT was setup to maximum output power. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. Compliance with the out-of-band emissions requirement is based on test being performed with an analyzer resolution bandwidth of 1 MHz. However in the 1 MHz band immediately outside and adjacent to the frequency block a resolution bandwidth of at least 1% of the fundamental emissions bandwidth may be employed. A display line was placed at -13 dBm to show compliance.

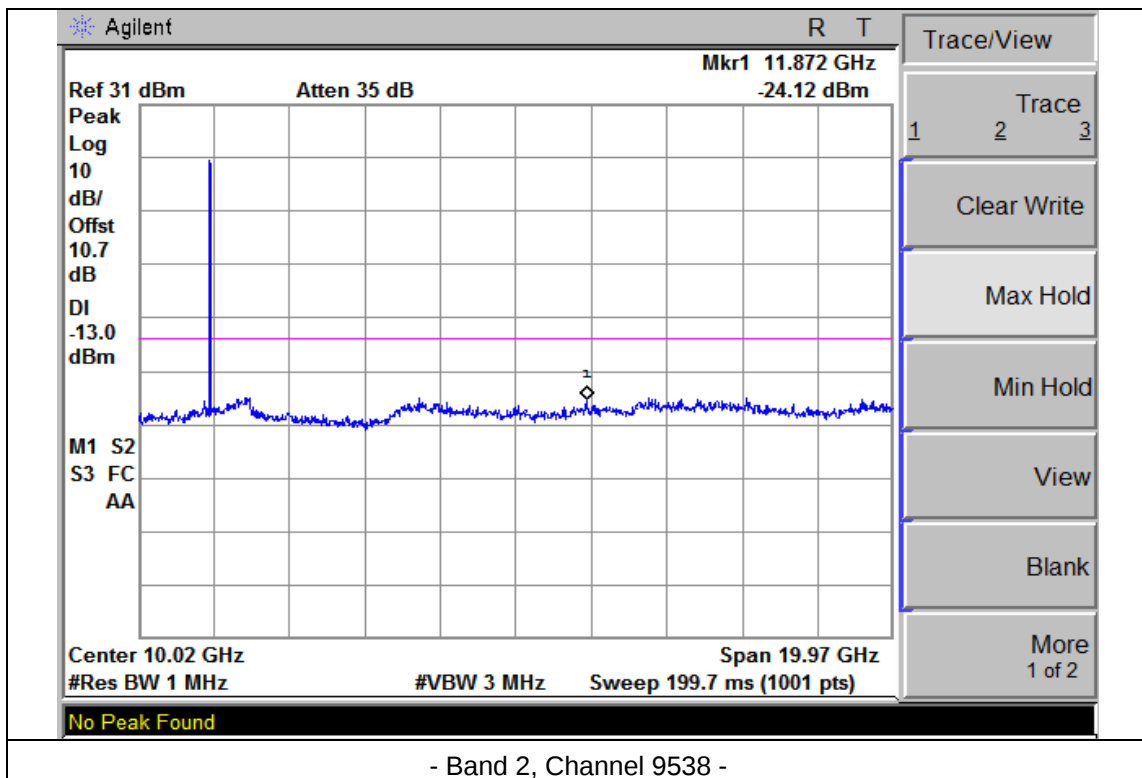
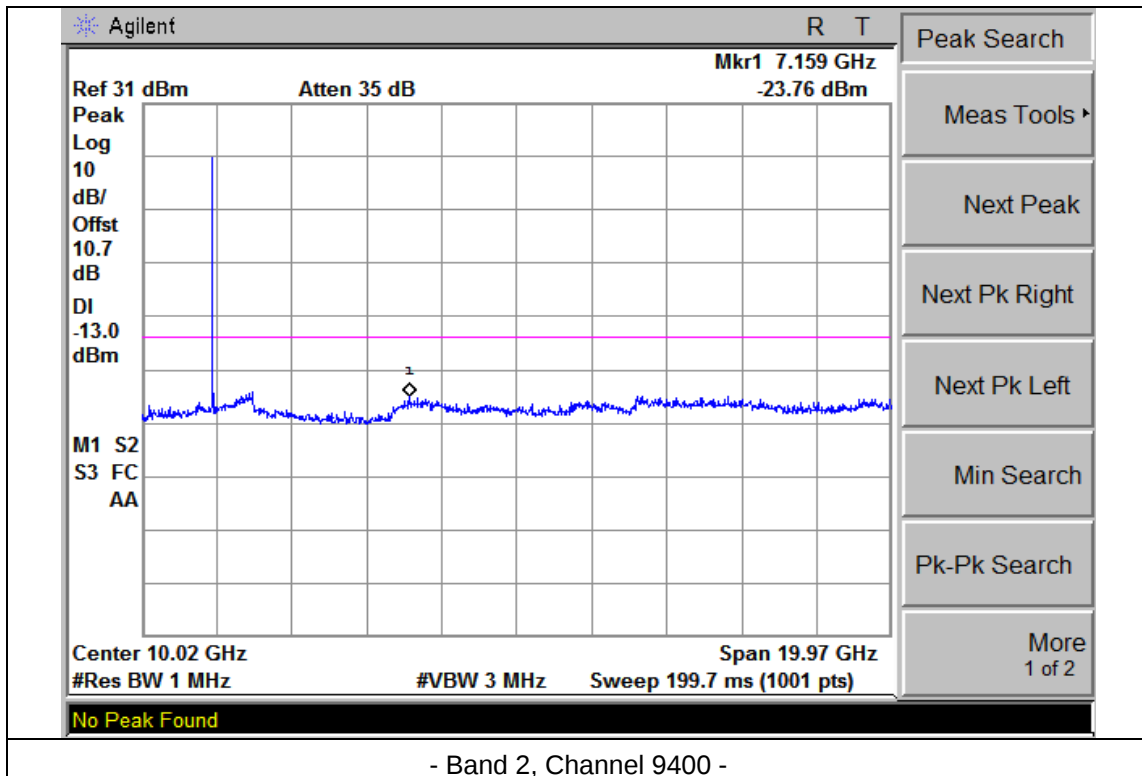
3.6.2. Limit

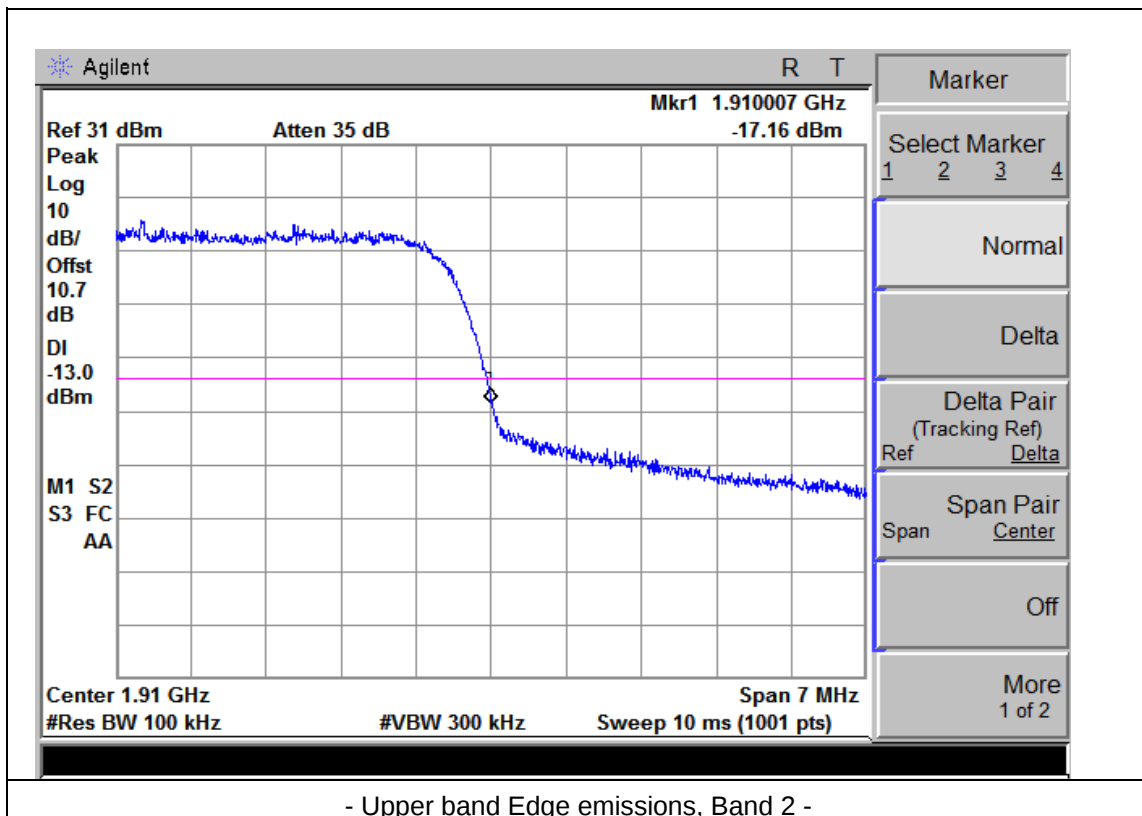
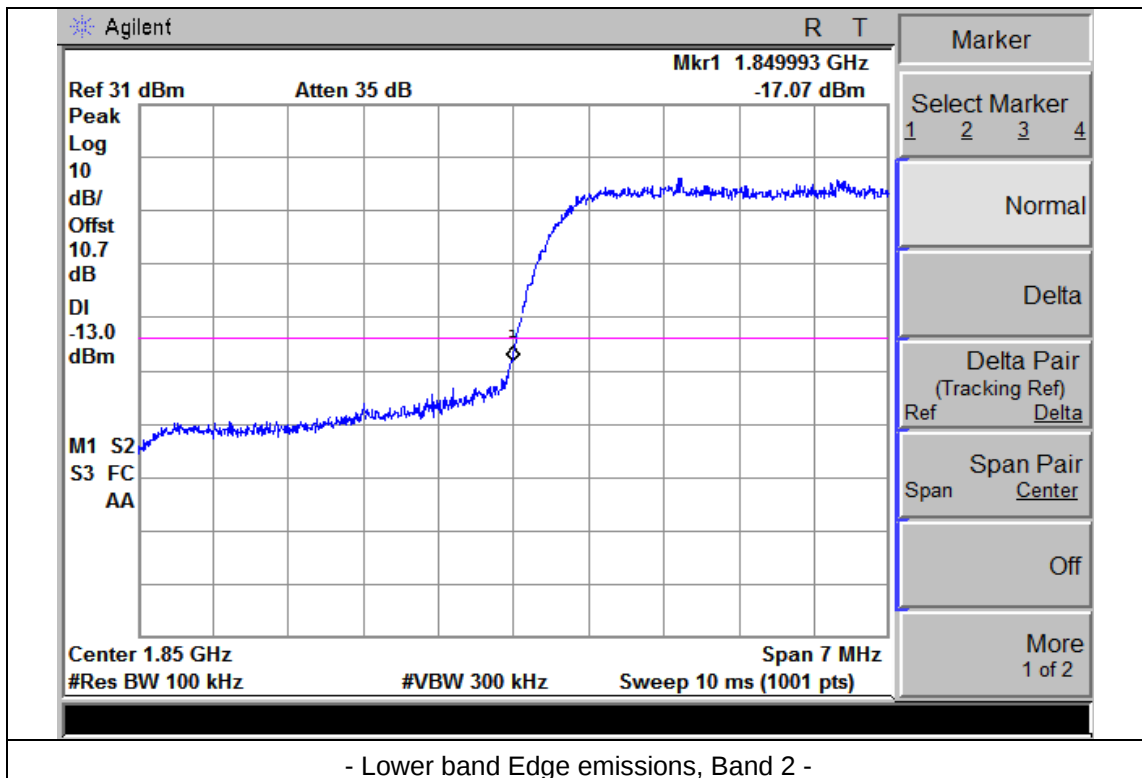
On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log(P)$ dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm.

3.6.3. Test Results

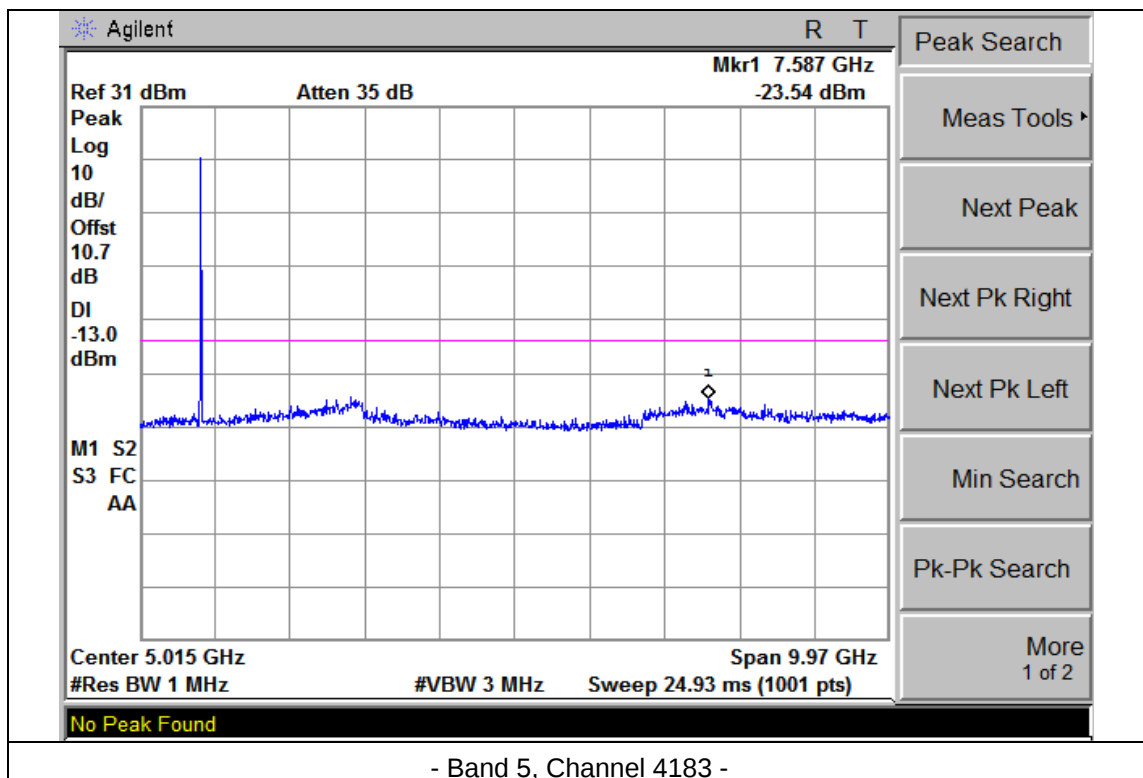
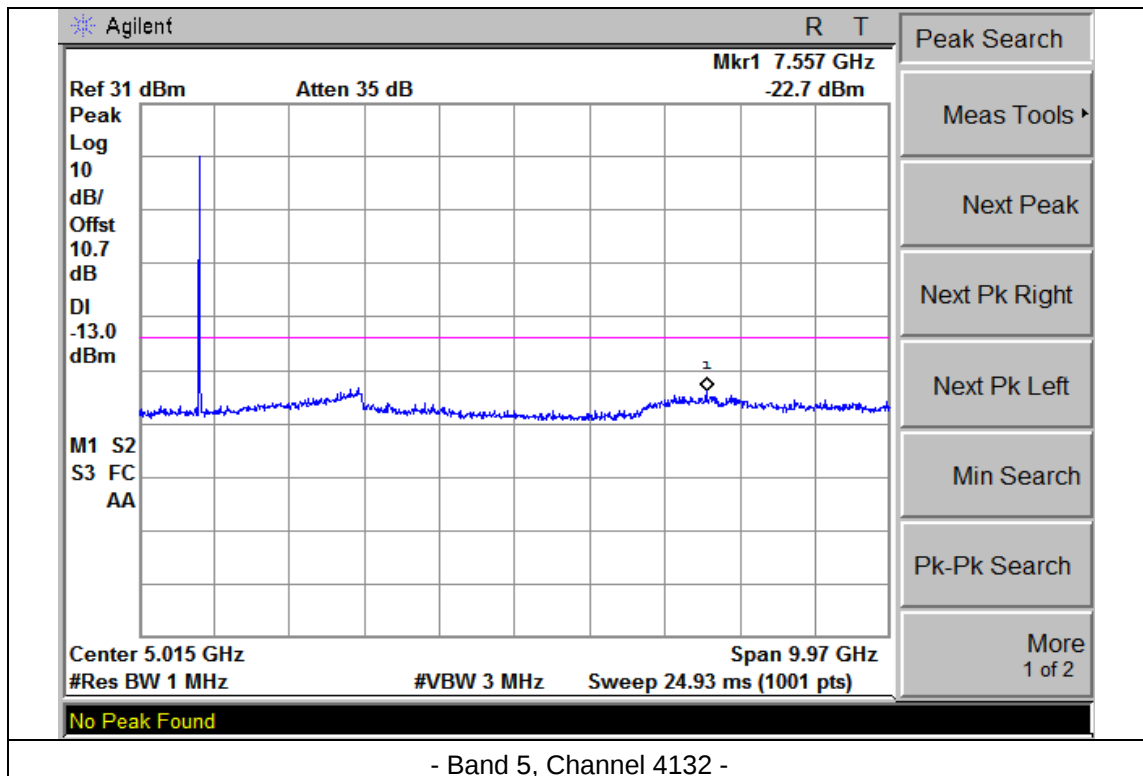
- WCDMA Band 2 Test Data

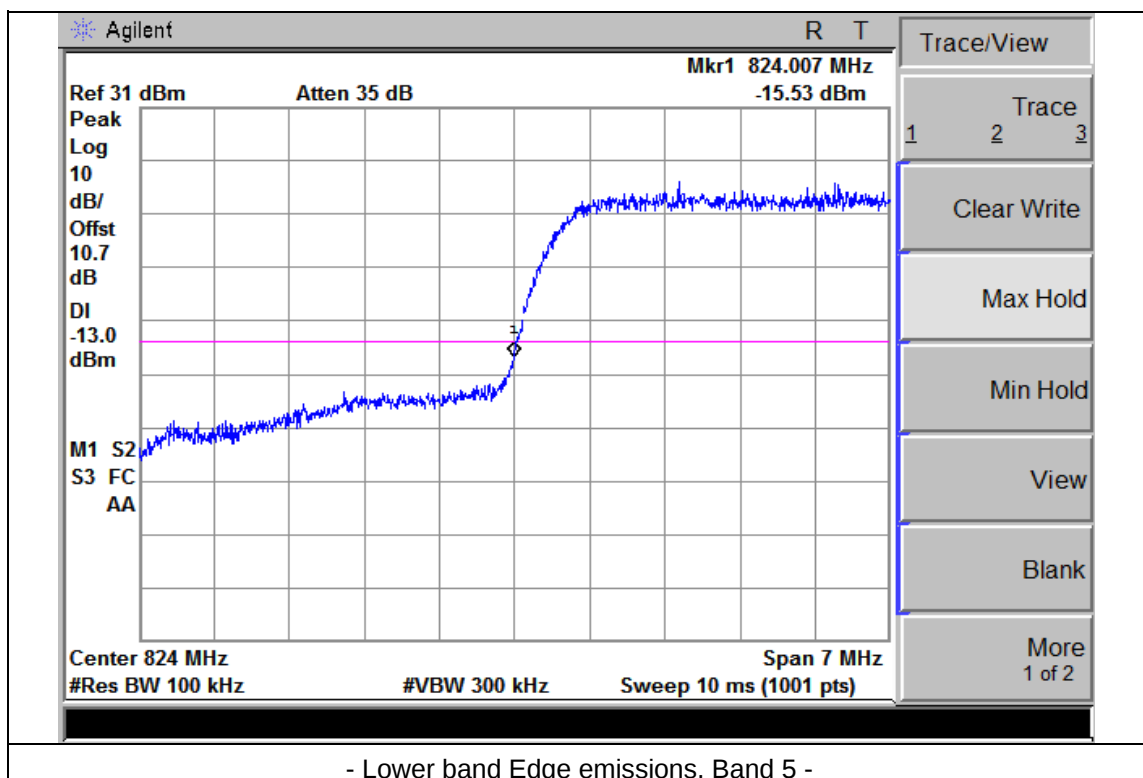
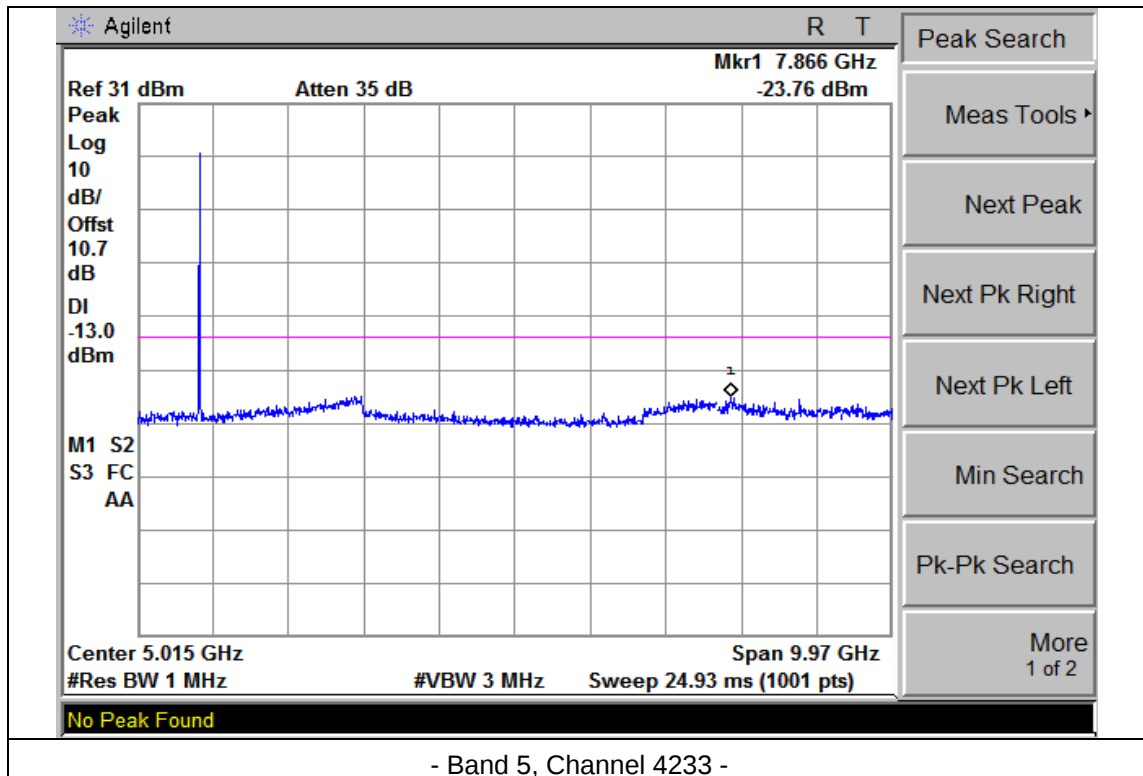


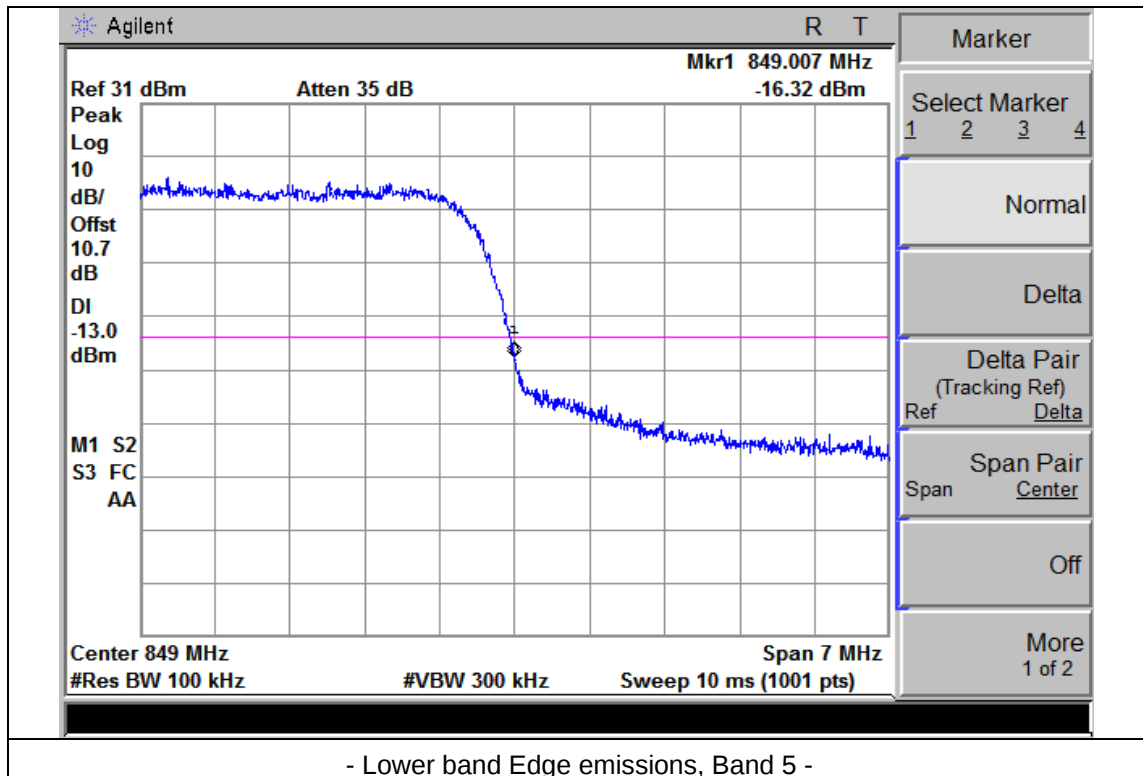




• WCDMA Band 5 Test Data







3.7. Frequency Stability / Temperature Variation

3.7.1. Test Procedure

The equipment under test is placed in an environmental chamber. Frequency measurements are made at the extremes of the temperature range -30° C to +50° C and at intervals of 10° C with the primary supply voltage set to the nominal battery operating voltage. A period of time sufficient to stabilize all components of the equipment is allowed at each frequency measurement. The maximum variation of frequency is measured. The test was done at middle channel.

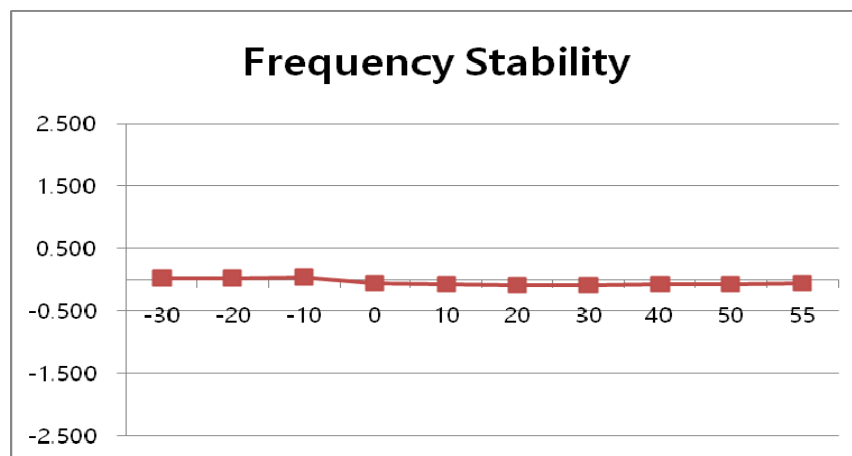
3.7.2. Limit

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within $\pm 0.000\ 25$ ($\pm 2.5\text{ppm}$) of the center frequency.

3.7.3. Test Results

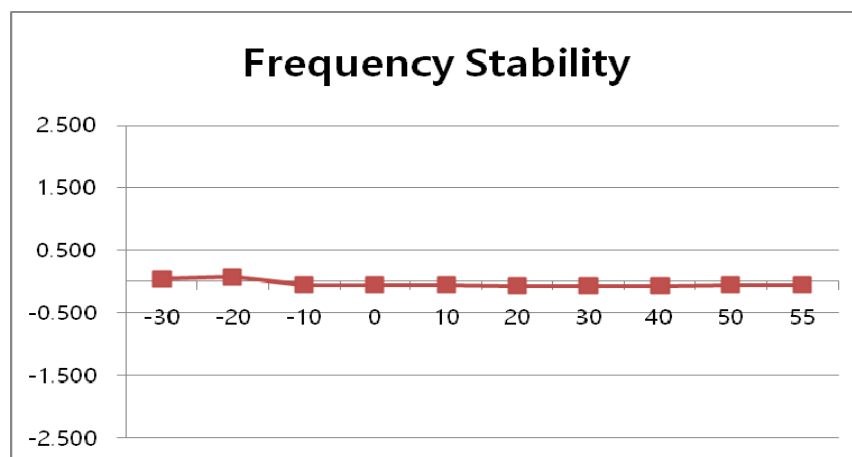
• WCDMA Band 2 Test Data

Voltage (%)	Power (VDC)	Temperature(°C)	Frequency Error (Hz)	Frequency Error (ppm)
100 %	+12.00	- 30	62	0.033
100 %		- 20	69	0.037
100 %		- 10	80	0.043
100 %		0	-89	-0.047
100 %		+ 10	-125	-0.066
100 %		+ 20	-151	-0.080
100 %		+ 30	-148	-0.079
100 %		+ 40	-133	-0.071
100 %		+ 50	-127	-0.068
100 %		+ 55	-92	-0.049
85 %	+10.20	+ 20	-149	-0.079
115 %	+13.80	+ 20	-137	-0.073



• WCDMA Band2 Test Data

Voltage(%)	Power (VDC)	Temperature(°C)	Frequency Error (Hz)	Frequency Error (ppm)
100 %	+12.00	- 30	33	0.039
100 %		- 20	64	0.077
100 %		- 10	-39	-0.047
100 %		0	-41	-0.049
100 %		+ 10	-50	-0.060
100 %		+ 20	-61	-0.073
100 %		+ 30	-63	-0.075
100 %		+ 40	-58	-0.069
100 %		+ 50	-48	-0.057
100 %		+ 55	-49	-0.059
85 %	+10.20	+ 20	-63	-0.075
115 %	+13.80	+ 20	-58	-0.069



4. TEST EQUIPMENTS

No.	Equipment	Manufacturer	Model	S/N	Calibration Due date
1	Spectrum Analyzer	Agilent	E4407B	US41443316	03-11-2015
2	Synthesized Sweeper	HP	83620A	3250A01653	03-03-2015
3	Digital RF Signal Generator	Agilent	E4438C	US41460859	02-18-2015
4	Signal Generator	R&S	SMIQ O3	DE22348	02-14-2015
5	PSA Series Spectrum Analyzer	Agilent	E4448A	US44300484	02-19-2015
6	DC Power Supply	Agilent	E4356A	MY41000296	02-11-2015
7	DC Power Supply	Agilent	E3645A	MY40000851	02-11-2015
8	AC Power Supply	Agilent	6811B	MY41000446	02-07-2015
9	Oscilloscope	Agilent	DSO6054A	MY44001104	01-22-2015
10	Directional Coupler	Agilent	87300C	MY44300126	03-04-2015
11	Directional Coupler	Agilent	773D	MY28390213	03-04-2015
12	VHF Attenuator	HP	355D	2522A45959	03-04-2015
13	Coaxial Attenuator	Weinschel	56-20	N8527	03-04-2015
14	Coaxial Attenuator	Agilent	8491B	50109	03-04-2015
15	Power Divider	HP	11636A	09084	03-07-2015
16	Power Splitter	HP	11667A	21063	03-04-2015
17	Temp/Humidity Chamber	ESPEC	SH-641	92007482	01-22-2016
18	Function/Arbitrary Waveform Generator	Agilent	33250A	MY40015758	04-24-2015
19	EMI Receiver	R&S	ESIB26	100280	03-12-2015
20	Pre-Amplifier	HP	83017A	MY39500982	02-19-2015
21	Biconi-Log Antenna	Schwarzbeck	VULB9168	9168-181	05-14-2015
22	Double Ridge Wave Guide	EMCO	3115	9012-3595	05-14-2015
23	Double Ridge Wave Guide	ETS-Lindgren	3116	2662	09-01-2015
24	Universal Radio Communication Tester	R&S	CMU200	110019	02-07-2015