

8.6 Radiated Spurious & Harmonic Emission (PCS)

FCC §2.1053, §24.238(a), RSS-133(6.5.1)

CH25 (1851.25 MHz)

Frequency (MHz)	Ant*. Pol.	Reading (dBm)	Level at Antenna Terminal (dBm)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)
3701.88	V	-50.8	-46.4	10.02	-36.4	-13	23.4
5552.50	V	-58.2	-48.9	10.46	-38.4	-13	25.4
7406.88	V	-64.5	-46.9	9.20	-37.7	-13	24.7
9255.00	V	-55.7	-36.4	10.23	-26.2	-13	13.2

Radiated Measurements at 3meters

CH 600 (1880.00 MHz)

Frequency (MHz)	Ant*. Pol.	Reading (dBm)	Level at Antenna Terminal (dBm)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)
3759.38	V	-55.7	-50.9	10.09	-40.8	-13	27.8
5640.00	V	-62.3	-53.3	10.54	-42.8	-13	29.8
7520.63	V	-66.1	-48.6	9.11	-39.5	-13	26.5
9400.00	V	-60.9	-41.7	10.08	-31.6	-13	18.6

Radiated Measurements at 3meters

CH 1175 (1908.75 MHz)

Frequency (MHz)	Ant*. Pol.	Reading (dBm)	Level at Antenna Terminal (dBm)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)
3816.88	V	-55.3	-50.3	10.15	-40.1	-13	27.1
5726.25	V	-57.0	-47.3	10.62	-36.7	-13	23.7
7634.38	V	-65.6	-48.9	9.03	-39.9	-13	26.9
9545.00	V	-63.8	-44.7	9.93	-34.8	-13	21.8

Radiated Measurements at 3meters

Note: Radiated Spurious Emission Measurements by Substitution Method according to ANSI/TIA/EIA-603-C-2..4, Aug. 17, 2004.

This device was tested under all R.C.s and S.O.s. The worst case is reported with FTAP Rate 2Slot 307.2 kbps/RETAP Rate 9.6 kbps with 'All Up' power control bits.

ERP(dB) =Level at Antenna Terminal(dBm) + Antenna Gain(dBd)

1. *Ant Pol. H =Horizontal V=Vertical
2. For measurements the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 1 MHz with peak measurements
3. The spectrum is measured to 10th harmonic and the worst-case emissions are reported.
No significant emissions were found beyond the fifth harmonic for this device.

8.7 Frequency Stability / Temperature Variation (Cellular)

Test channel : Middle channel (836.52 MHz)

Standard test voltage : 3.8 Vdc

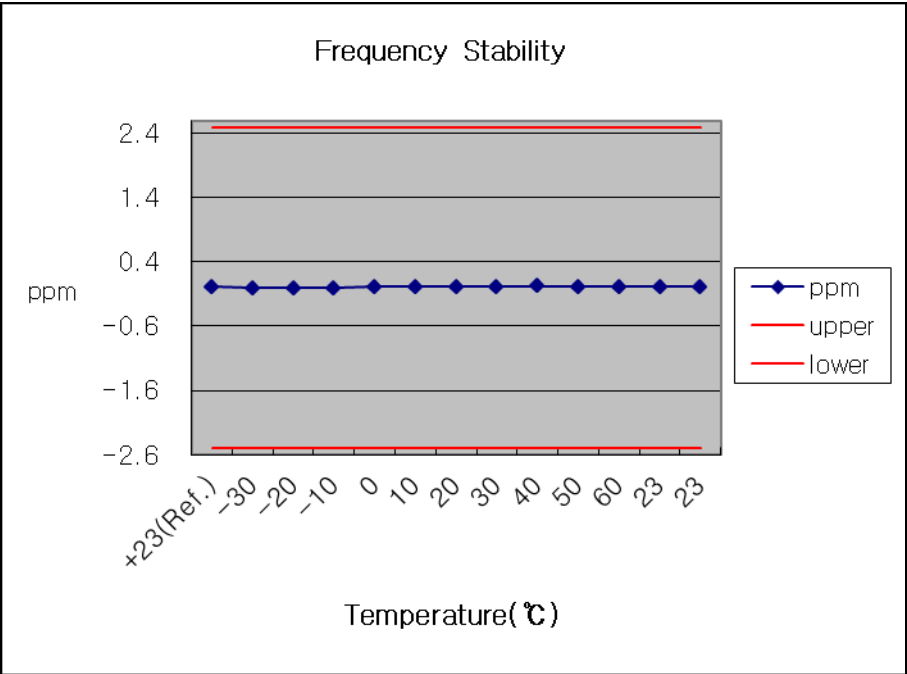
Deviation Limit : ± 2.5 ppm

Measurement Result :

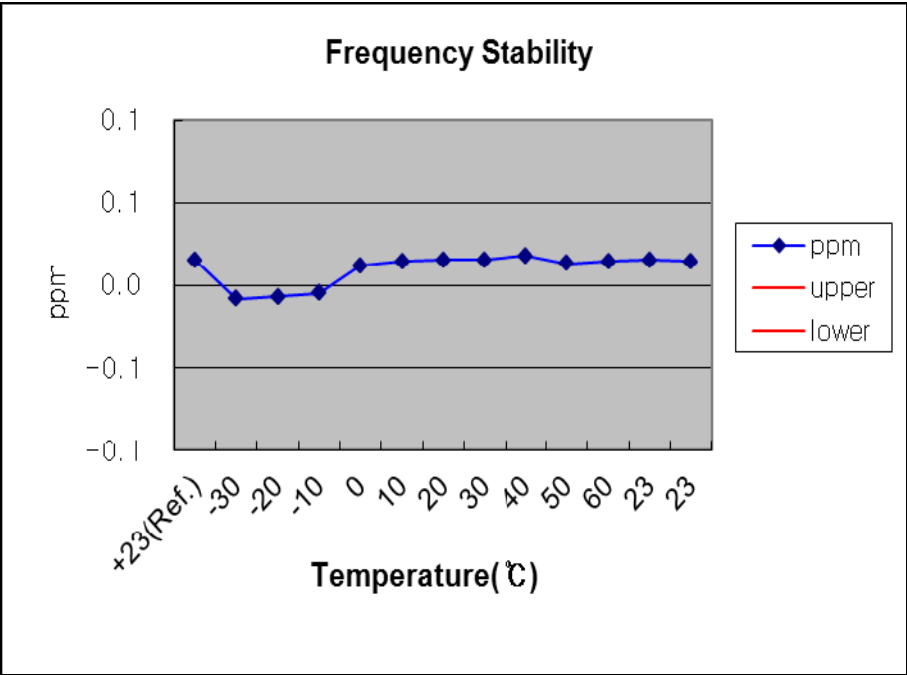
Voltage (%)	Power (Vdc)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	ppm
100%	3.8	+23(Ref.)	836,520,013	13	0.0155
100%		-30	836,519,993	-7	-0.0084
100%		-20	836,519,994	-6	-0.0072
100%		-10	836,519,996	-4	-0.0048
100%		0	836,520,010	10	0.0120
100%		10	836,520,012	12	0.0143
100%		20	836,520,013	13	0.0155
100%		30	836,520,013	13	0.0155
100%		40	836,520,015	15	0.0179
100%		50	836,520,011	11	0.0131
100%		60	836,520,012	12	0.0143
85%	3.23	23	836,520,013	13	0.0155
115%	4.37	23	836,520,012	12	0.0143

***The temperature is varied from -30°C to +60°C using an environmental chamber.**

Frequency Stability Graph (PCS)



Zoom In



8.8 Frequency Stability / Temperature Variation (PCS)

Test channel : Middle channel (1880.00 MHz)

Standard test voltage : 3.8 Vdc

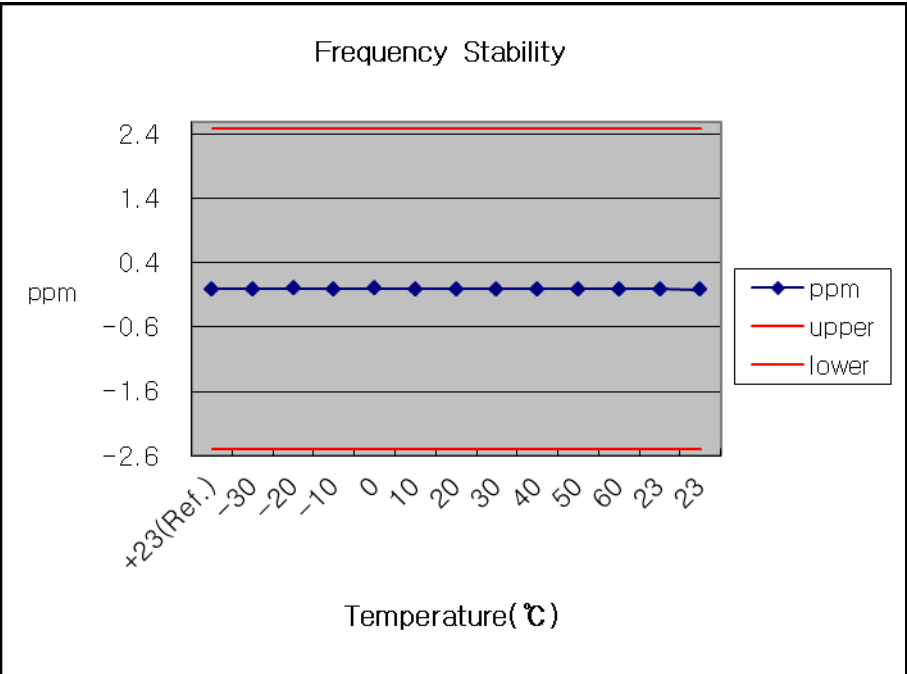
Deviation Limit : ± 2.5 ppm

Measurement Result :

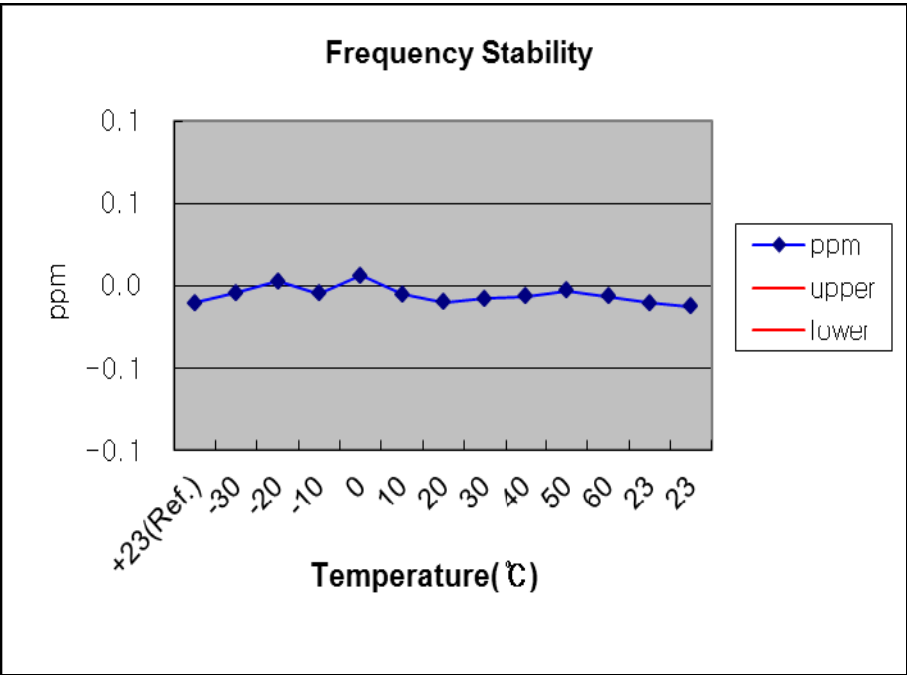
Voltage (%)	Power (Vdc)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	ppm
100%	3.8	+23(Ref.)	1,879,999,980	-20	-0.0106
100%		-30	1,879,999,992	-8	-0.0043
100%		-20	1,880,000,005	5	0.0027
100%		-10	1,879,999,991	-9	-0.0048
100%		0	1,880,000,011	11	0.0059
100%		10	1,879,999,990	-10	-0.0053
100%		20	1,879,999,981	-19	-0.0101
100%		30	1,879,999,985	-15	-0.0080
100%		40	1,879,999,988	-12	-0.0064
100%		50	1,879,999,994	-6	-0.0032
100%		60	1,879,999,988	-12	-0.0064
85%	3.23	23	1,879,999,980	-20	-0.0106
115%	4.37	23	1,879,999,976	-24	-0.0128

***The temperature is varied from -30°C to +60°C using an environmental chamber.**

Frequency Stability Graph (PCS)



Zoom In



8.9 Receiver Spurious Emissions

RSS-Gen(6.1), RSS-132(4.6), RSS-133(6.6)

Frequency (MHz)	Pol* (H/V)	Reading (dB μ V/m)	AF+CL+Amp (dB)**	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
43.10	V	43.0	-17.3	25.7	40.0	14.3
157.07	V	38.3	-10.2	28.1	43.5	15.4
681.84	H	39.1	-5.3	33.8	46.0	12.2
706.09	H	39.0	-5.3	33.7	46.0	12.3
748.29	V	39.1	-4.5	34.6	46.0	11.4
881.66	V	40.5	-2.4	38.1	46.0	7.9

Radiated Measurements at 3 meters

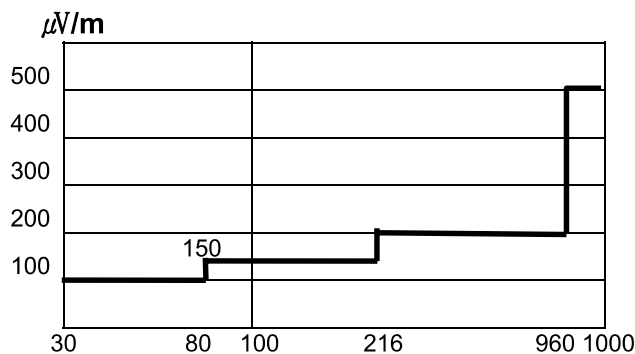


Fig. 5. Limits at 3 meters

Notes:

1. All modes were measured and the worst-case emission was reported.
- 2 The radiated limits are shown on Figure 5. Above 1 GHz the limit is 500 μ V/m.

MHz

Notes:

1. *Pol. H = Horizontal, V = Vertical
2. **AF + CL + Amp. = Antenna Factor + Cable Loss + Amplifier.
3. Measurements using CISPR quasi-peak mode.
4. The limit is on the IC RSS GEN Clause 6.1.

9. ACCURACY OF MEASUREMENT

The Measurement Uncertainties stated were calculated in accordance with the requirements of measurement uncertainty contained in CISPR 16-4-2 with the confidence level of 95%

1. Conducted Uncertainty Calculation

Source of Uncertainty	X_i	Uncertainty of X_i		Coverage factor k	$u(X_i)$ (dB)	C_i	$C_i u(X_i)$ (dB)
		Value (dB)	Probability Distribution				
Receiver reading	RI	± 0.1	normal 1	1.000	0.1	1	0.1
Attenuation AMN-Receiver	LC	± 0.08	normal 2	2.000	0.04	1	0.04
AMN Voltage division factor	LAMN	± 0.8	normal 2	2.000	0.4	1	0.4
Sine wave voltage	dVSW	± 2.00	normal 2	2.000	1.00	1	1.00
Pulse amplitude response	dVPA	± 1.50	rectangular	1.732	0.87	1	0.87
Pulse repetition rate response	dVPR	± 1.50	rectangular	1.732	0.87	1	0.87
Noise floor proximity	dVNF	± 0.00	-	-	0.00	1	0.00
AMN Impedance	dZ	± 1.80	triangular	2.449	0.73	1	0.73
Ⓐ Mismatch	M	+ 0.70	U-Shaped	1.414	0.49	1	0.49
Ⓑ Mismatch	M	- 0.80	U-Shaped	1.414	- 0.56	1	- 0.56
Measurement System Repeatability	RS	0.05	normal 1	1.000	0.05	1	0.05
Remark	Ⓐ: AMN-Receiver Mismatch : + Ⓑ: AMN-Receiver Mismatch : -						
Combined Standard Uncertainty	Normal			± 1.88			
Expanded Uncertainty U	Normal ($k = 2$)			± 3.76			

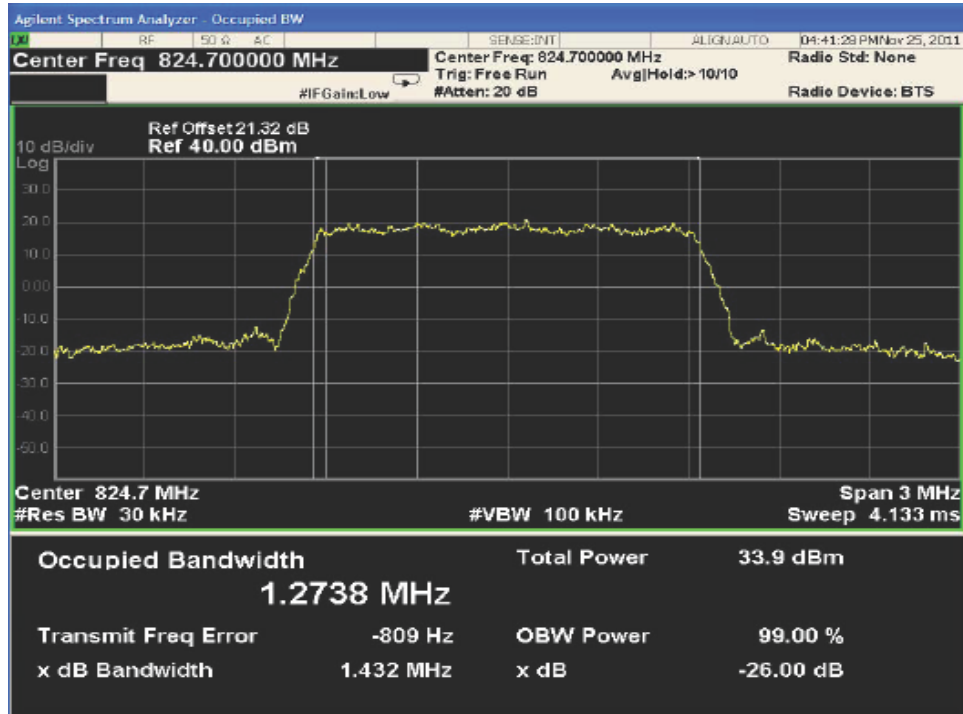
2. Radiation Uncertainty Calculation

Source of Uncertainty	X_i	Uncertainty of X_i		Coverage factor k	$u(X_i)$ (dB)	C_i	$C_i u(X_i)$ (dB)
		Value (dB)	Probability Distribution				
Receiver reading	RI	± 0.10	normal 1	1.000	0.10	1	0.10
Sine wave voltage	dV_{sw}	± 2.00	normal 2	2.000	1.00	1	1.00
Pulse amplitude response	dV_{pa}	± 1.50	rectangular	1.732	0.87	1	0.87
Pulse repetition rate response	dV_{pr}	± 1.50	rectangular	1.732	0.87	1	0.87
Noise floor proximity	dV_{nf}	± 0.50	normal 2	2.000	0.25	1	0.25
Antenna Factor Calibration	AF	± 1.50	normal 2	2.000	0.75	1	0.75
Attenuation Antenna-receiver	CL	± 0.52	normal 2	2.000	0.26	1	0.26
Antenna Directivity	AD	± 1.00	rectangular	1.732	0.58	1	0.58
Antenna Factor Height Dependence	AH	± 0.50	rectangular	1.732	0.29	1	0.29
Antenna Phase Centre Variation	AP	± 0.30	rectangular	1.732	0.17	1	0.17
Antenna Factor Frequency Interpolation	AI	± 0.30	rectangular	1.732	0.17	1	0.17
Site Imperfections	SI	± 4.00	triangular	2.449	1.63	1	1.63
Measurement Distance Variation	DV	± 0.10	rectangular	1.732	0.06	1	0.06
Antenna Balance	$Dbal$	± 0.90	rectangular	1.732	0.52	1	0.52
Cross Polarisation	$DCross$	± 0.90	rectangular	1.732	0.52	1	0.52
Ⓐ Mismatch	M	+ 0.25	U-Shaped	1.414	0.18	1	0.18
Ⓑ Mismatch	M	- 0.26	U-Shaped	1.414	- 0.18	1	- 0.18
Ⓒ Mismatch	M	+ 0.98	U-Shaped	1.414	0.69	1	0.69
Ⓓ Mismatch	M	- 1.11	U-Shaped	1.414	- 0.79	1	- 0.79
Measurement System Repeatability	RS	0.09	normal 1	1.000	0.09	1	0.09
Remark	Ⓐ: Biconical Antenna-receiver Mismatch : + (< 200 MHz) Ⓑ: Biconical Antenna-receiver Mismatch : - (< 200 MHz) Ⓒ: Log Periodic Antenna-receiver Mismatch : + ($\geq$ 200 MHz) Ⓓ: Log Periodic Antenna-receiver Mismatch : - ($\geq$ 200 MHz)						
Combined Standard Uncertainty	Normal			± 2.63 (< 200 MHz) ± 2.74 ($\geq$ 200 MHz)			
Expanded Uncertainty U	Normal ($k = 2$)			± 5.26 (< 200 MHz) ± 5.48 ($\geq$ 200 MHz)			

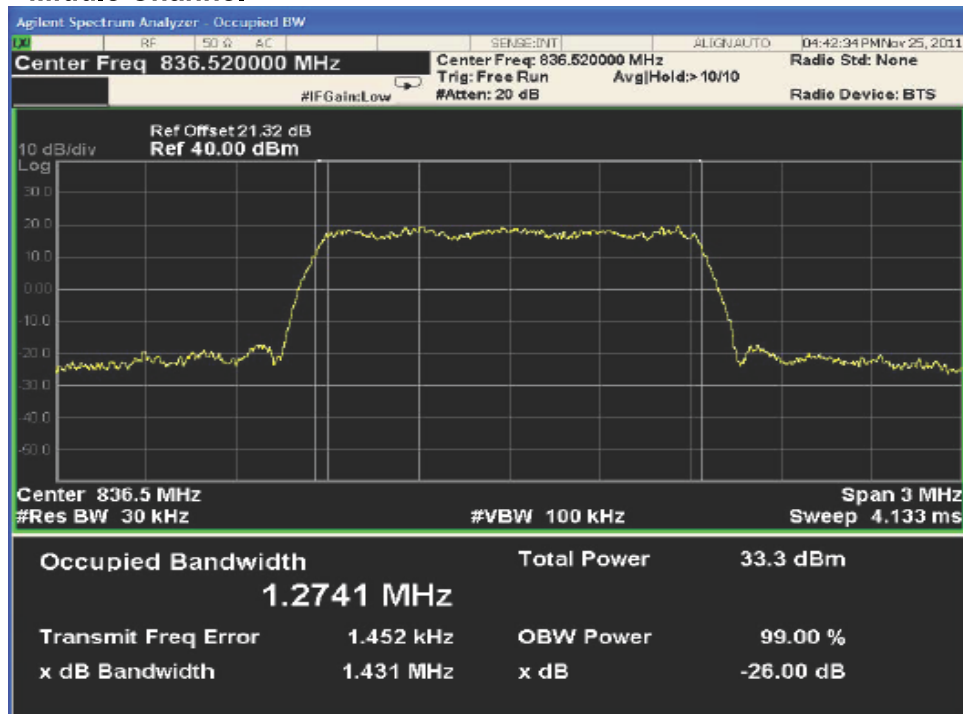
10. Test Plots (Cellular)

● Occupied Bandwidth / 26dB Bandwidth

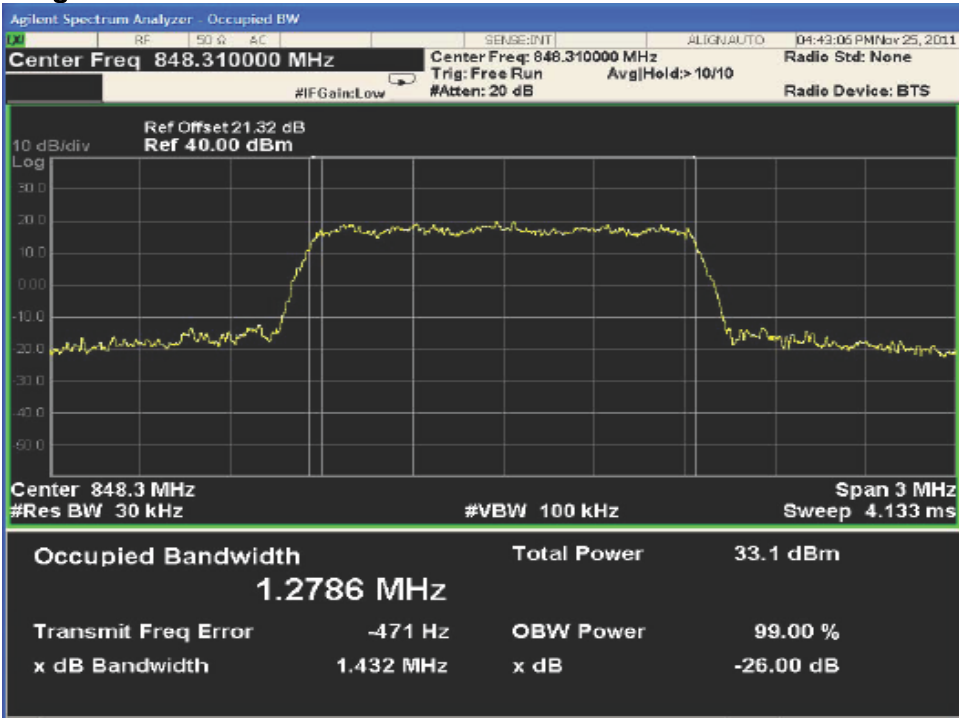
Low Channel



Middle Channel

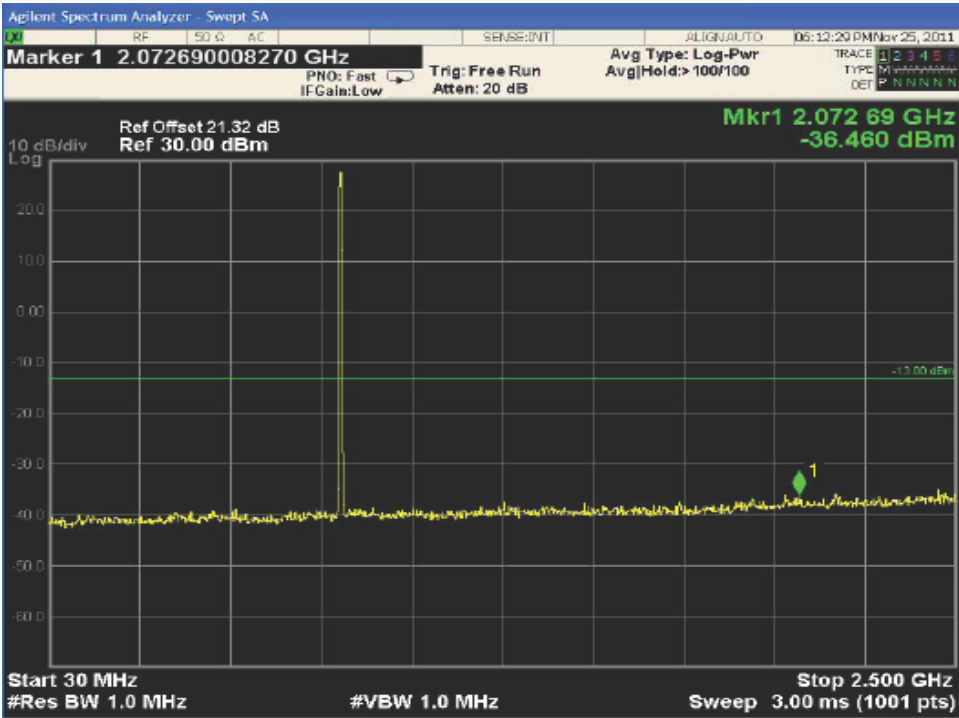


High Channel



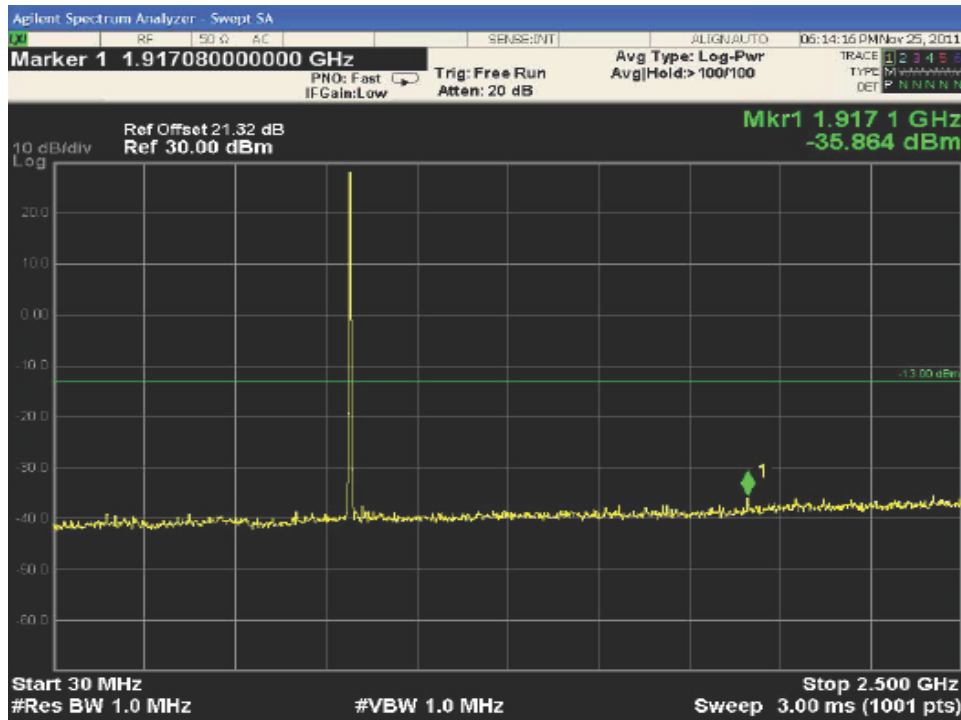
● Spurious Emission at antenna Terminals

Low Channel



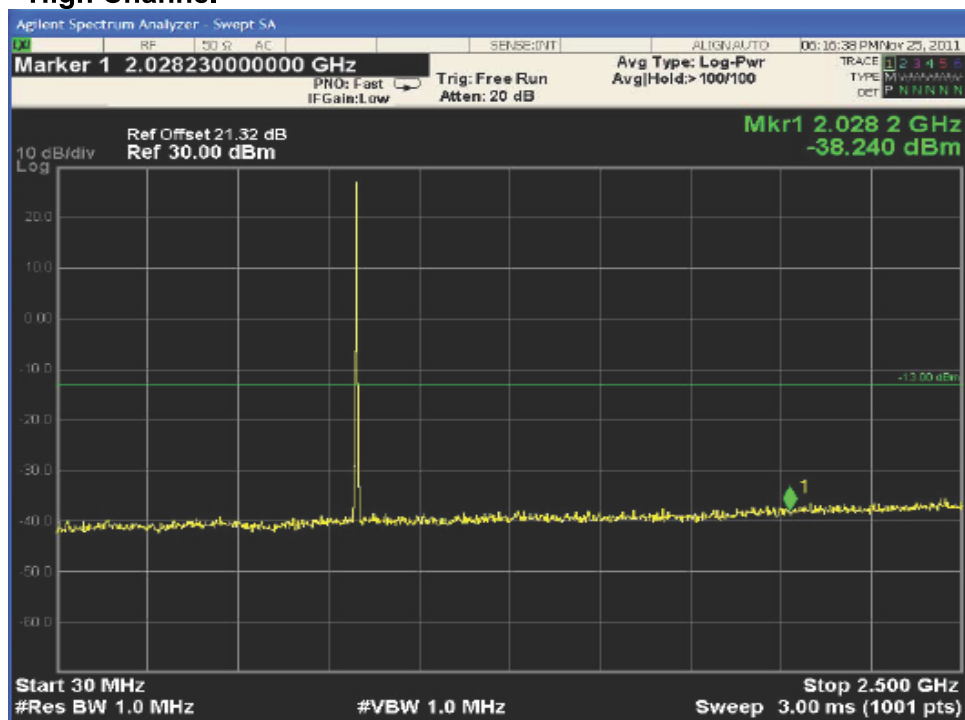


Middle Channel





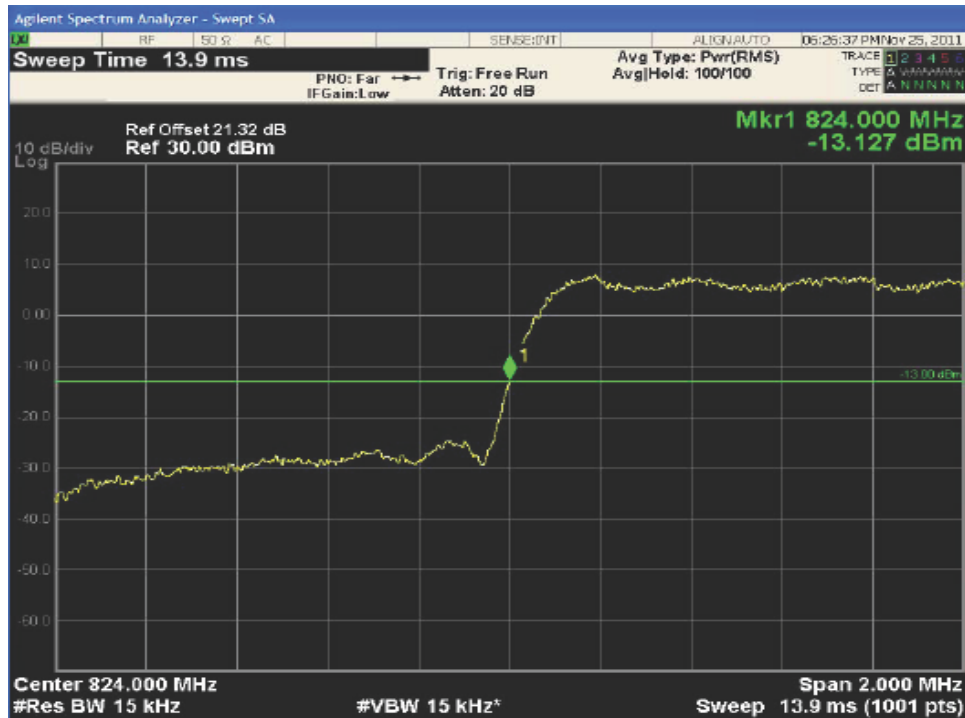
High Channel





Band Edge

Low Channel





High Channel

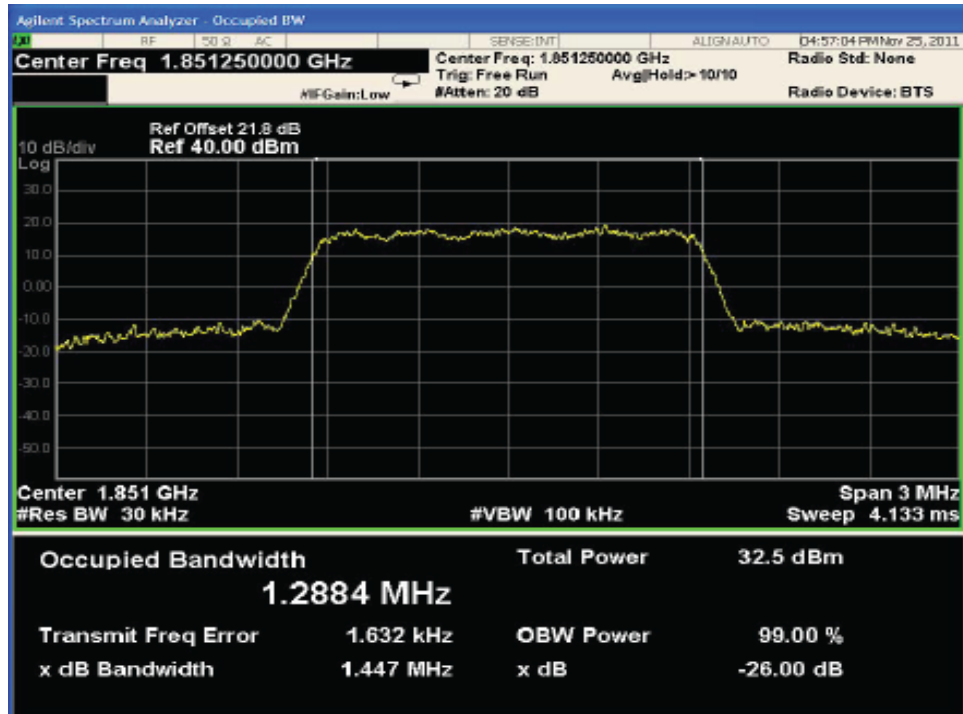




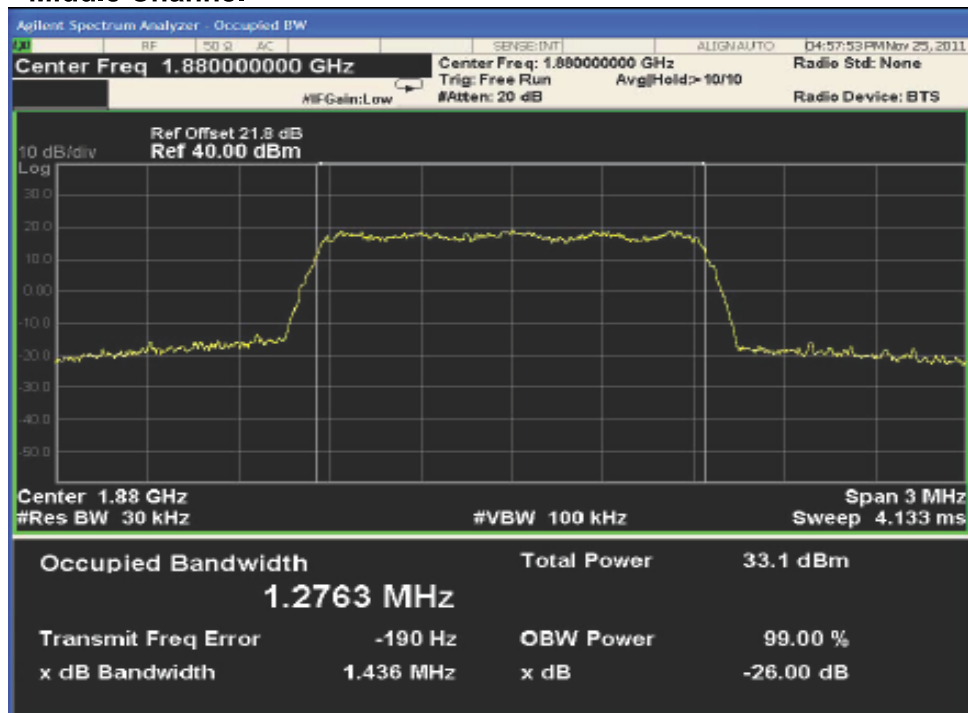
11. Test Plots (PCS)

● Occupied Bandwidth / 26dB Bandwidth

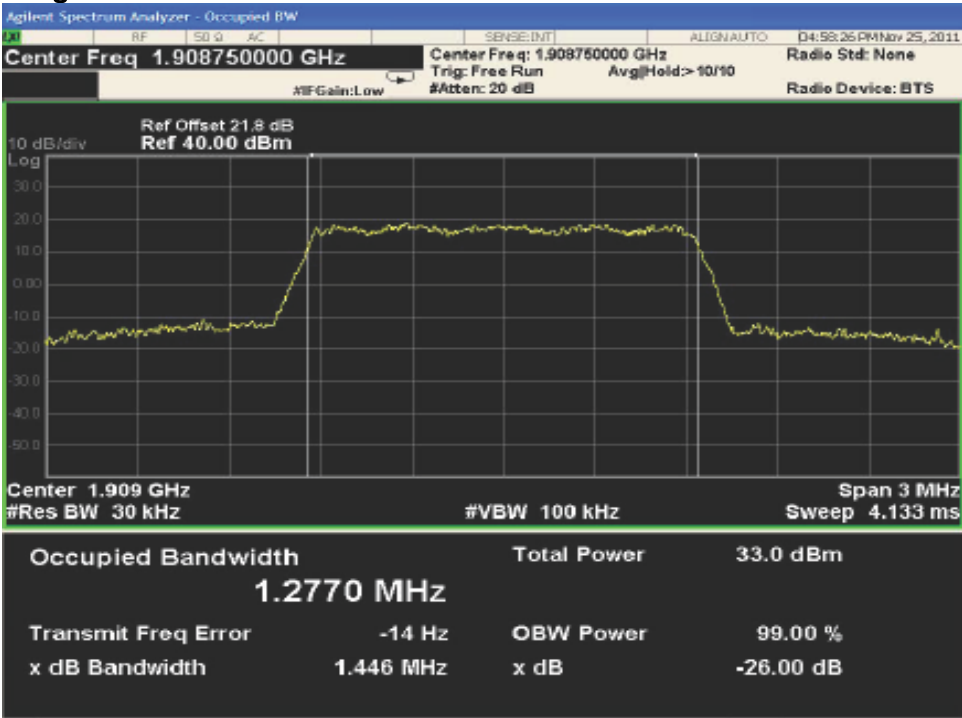
Low Channel



Middle Channel

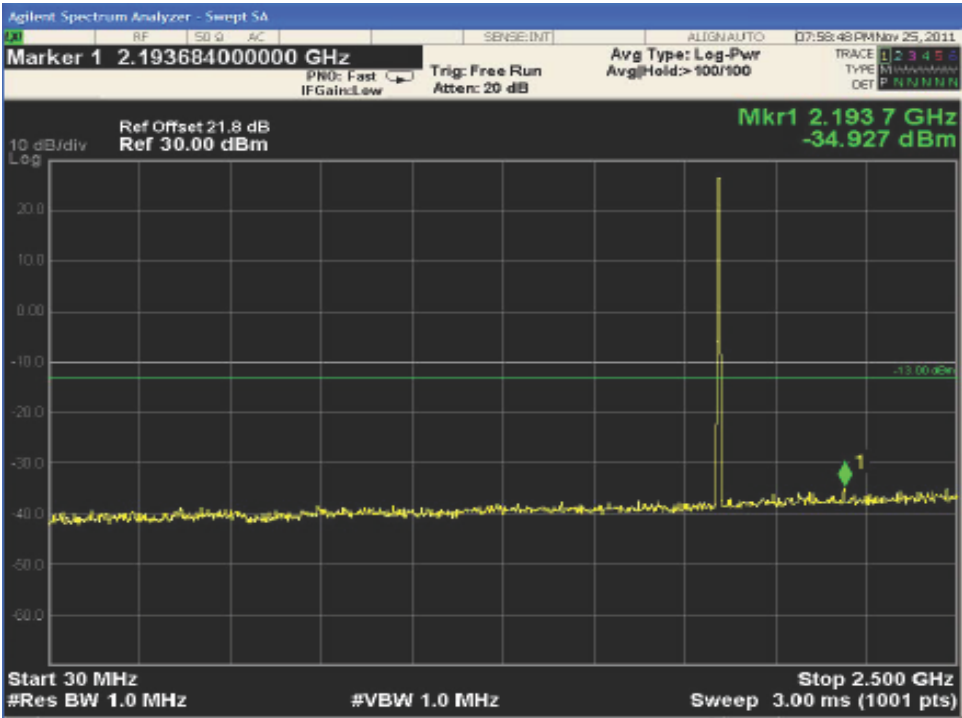


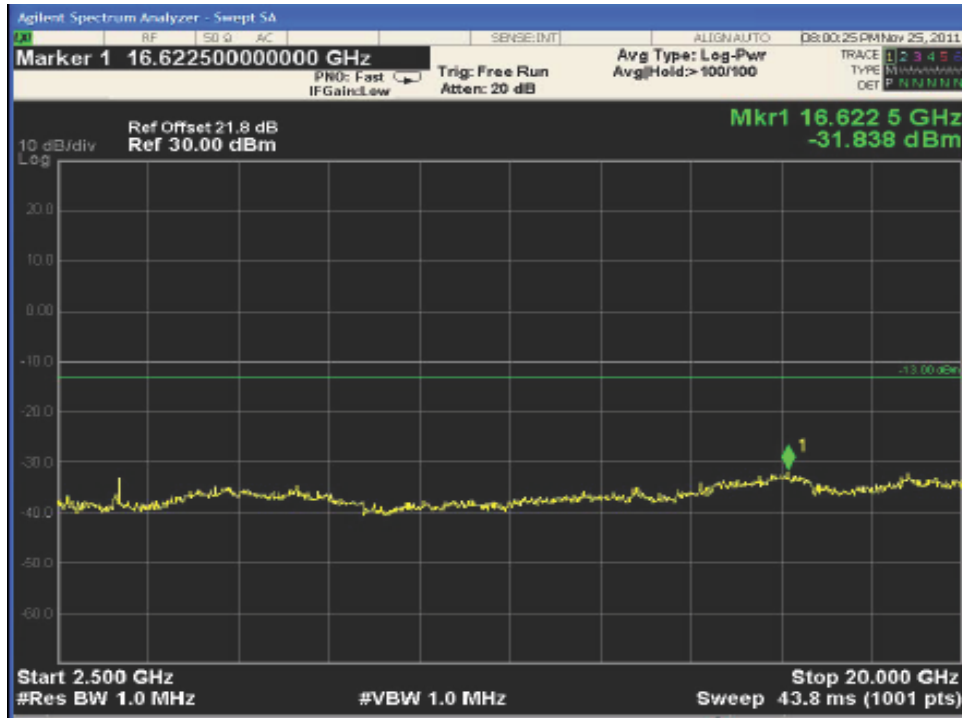
High Channel



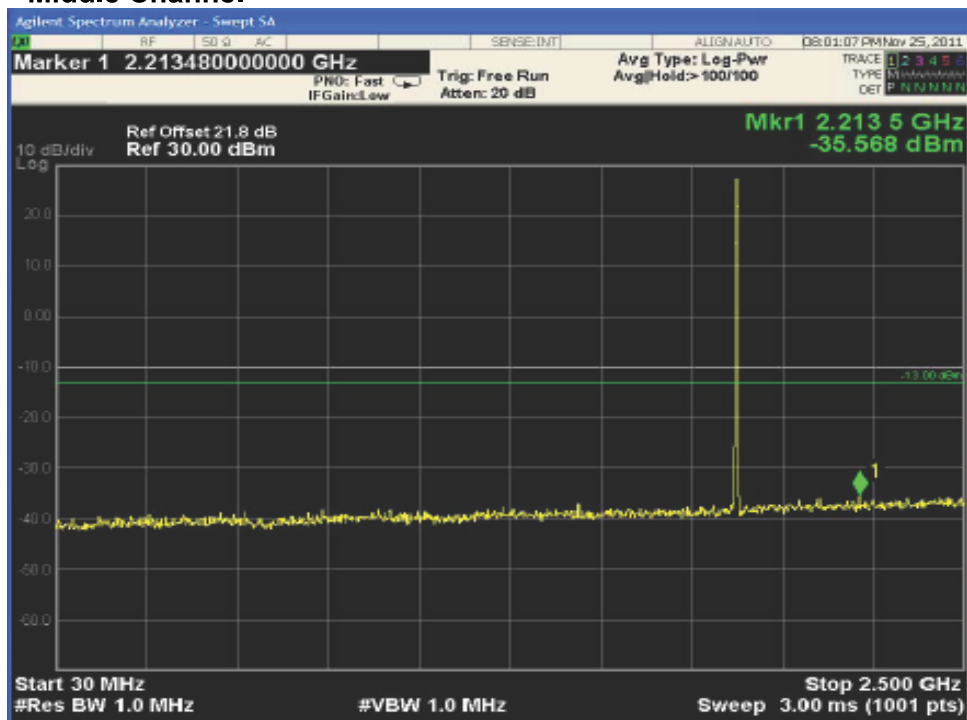
● Spurious Emission at antenna Terminals

Low Channel



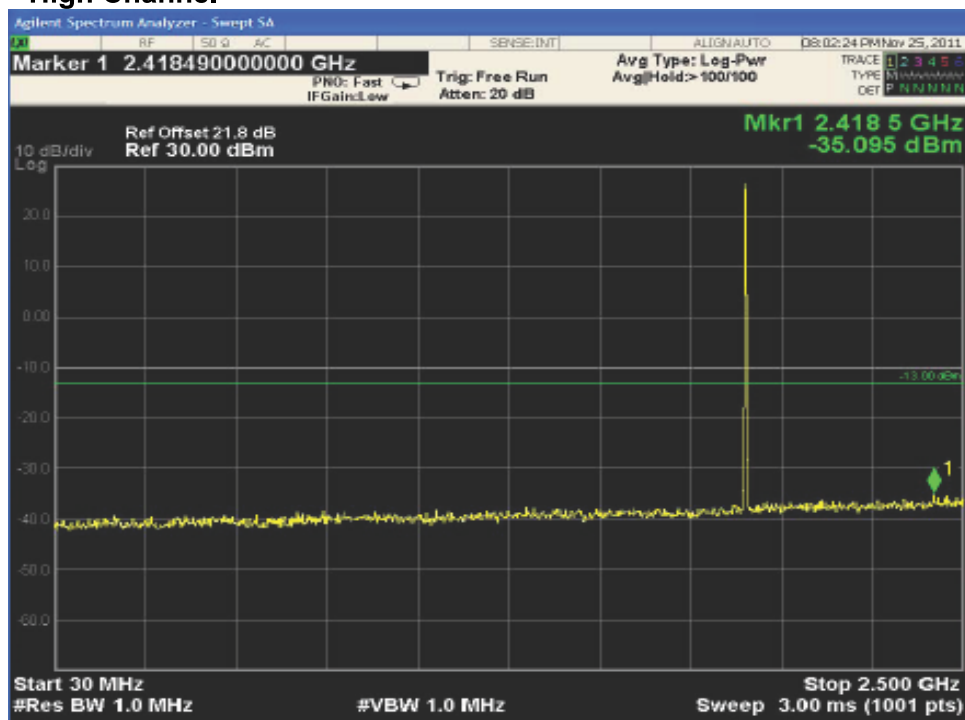


Middle Channel





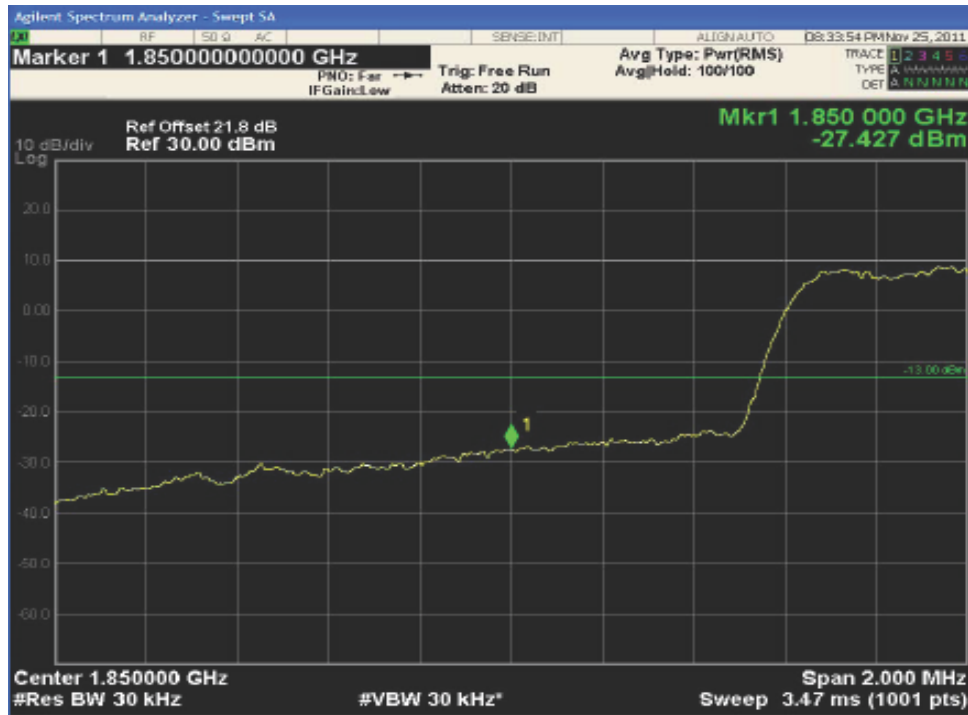
High Channel

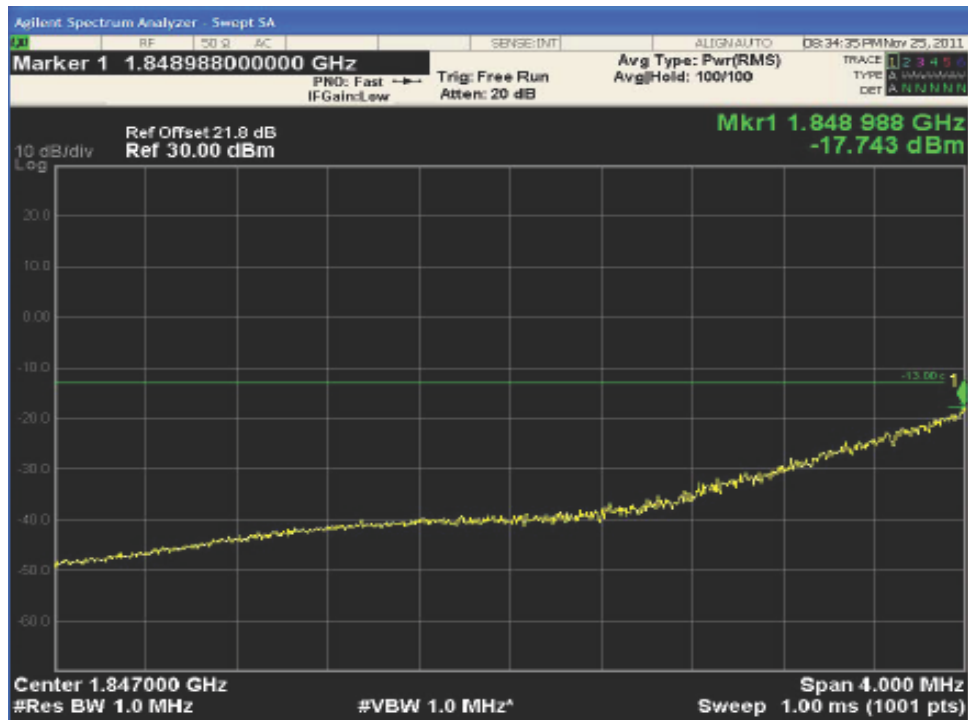




● Band Edge

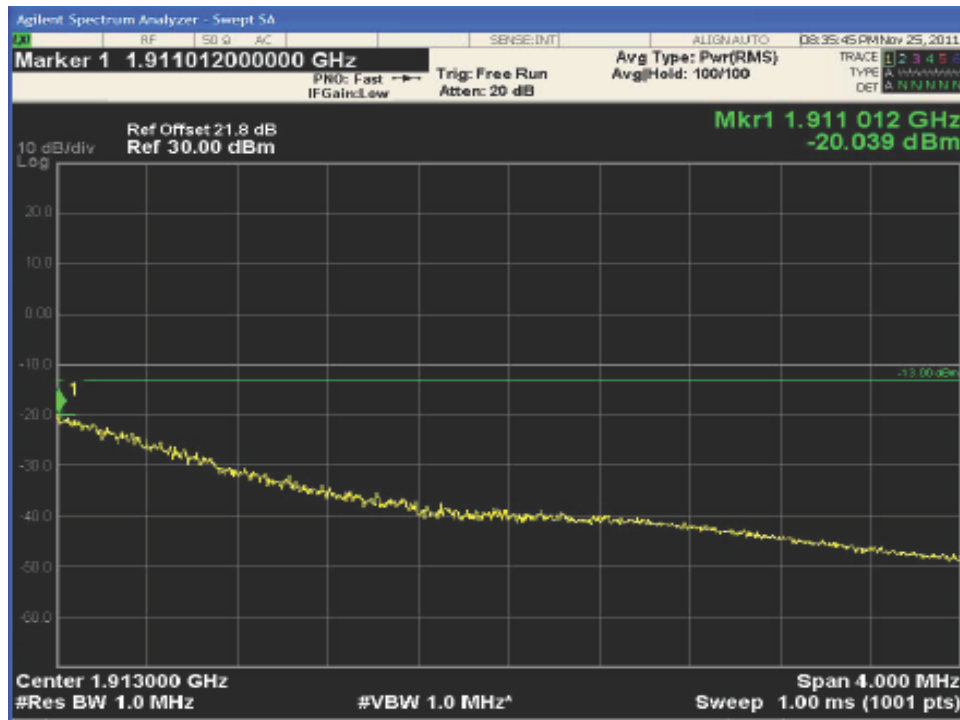
Low Channel





High Channel





12. Test Equipment List

No.	Instrument	Manufacturer	Model	Serial No.	Calibration Date	Calibration Interval
1	*Test Receiver	R & S	ESCS 30	833364/020	Jan. 14 2011	1 year
2	Test Receiver	R & S	ESCS 30	100302	Oct. 12 2011	1 year
3	*Amplifier	HP	8447F	2805A03427	Jul. 19 2011	1 year
4	*Amplifier	Sonoma Instrument	310N	291916	Jul. 19 2011	1 year
5	*Amplifier	R & S	SCU-26	10011	Jun. 01 2011	1 year
6	*Pre Amplifier	HP	8449B	3008A00107	Jan. 13 2011	1 year
7	*Pre Amplifier	HP	8447F	2805A03351	Oct. 06 2011	1 year
8	*Wireless Communication Test Set	Agilent	E5515C	MY48360948	Feb. 07 2011	1 year
9	*Signal Generator	R & S	SMP02	833286/003	Jul. 19 2011	1 year
10	*Spectrum Analyzer	R & S	N9020A	MY51110087	Jun. 03 2011	1 year
11	*Spectrum Analyzer	R & S	FSP40	100361	Jul. 19 2011	1 year
12	*Loop Antenna	EMCO	6502	8911-2436	Jan. 19 2010	2 year
13	*Biconical Log Antenna	ARA	LPB-2520/A	1180	Apr. 14 2010	2 year
14	*Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-508	Dec. 24 2010	2 year
15	*Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-474	Jul. 14 2010	2 year
16	*Horn Antenna	Q-par Angus	QSH20S20	8179	Apr. 12 2010	2 year
17	*Trilog-Broadband Antenna	SCHWARZBECK	VULB 9168	9168-257	Apr. 14 2010	2 year
18	*Directional Coupler	HP	778D	15550	Jan. 13 2011	1 year
19	LISN	R & S	ESH3-Z5	833874/006	Oct. 12 2011	1 year
20	LISN	R & S	ESH2-Z5	100227	Apr. 06 2011	1 year
21	*Position Controller	DAEIL EMC	N/A	N/A	N/A	N/A
22	*Turn Table	DAEIL EMC	N/A	N/A	N/A	N/A
23	*Antenna Mast	DAEIL EMC	N/A	N/A	N/A	N/A
24	*Anechoic Chamber	EM Eng.	N/A	N/A	N/A	N/A
25	*Shielded Room	EM Eng.	N/A	N/A	N/A	N/A
26	*Position Controller	Seo-Young EMC	N/A	N/A	N/A	N/A
27	*Turn Table	Seo-Young EMC	N/A	N/A	N/A	N/A
28	*Antenna Mast	Seo-Young EMC	N/A	N/A	N/A	N/A
29	*Anechoic Chamber	Seo-Young EMC	N/A	N/A	N/A	N/A
30	*Shielded Room	Seo-Young EMC	N/A	N/A	N/A	N/A