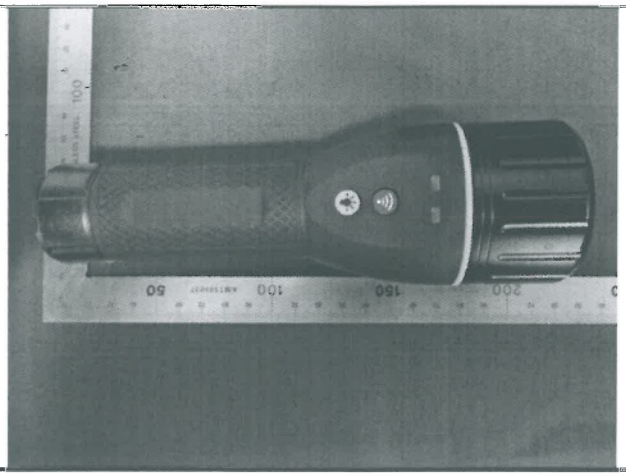
Prüfbericht-Nr.: *Test Report No.:*	**50046621 001**	**Auftrags-Nr.:** *Order No.:*	**154169393**	**Seite 1 von 132** *Page 1 of 132*
Kunden-Referenz-Nr.: *Client Reference No.:*	**52158935**	**Auftragsdatum:** *Order date:*	**2016.05.23**	

Auftraggeber: *Client:*	**GENERAL TOOLS & INSTRUMENTS COMPANY LLC** 75 Seaview Drive Secaucus New Jersey United States 07094
Prüfgegenstand: *Test item:*	**ToolSmart Illuminated Inspection Camera**
Bezeichnung / Typ-Nr.: *Identification / Type No.:*	**TS07** **FCC ID: YRKTS07**
Auftrags-Inhalt: *Order content:*	**Complete test**
Prüfgrundlage: *Test specification:*	**FCC CFR47 Part 15, Subpart C Section 15.247** **ANSI C63.10: 2013** **KDB 558074 D01 DTS Meas Guidance v03r05**
Wareneingangsdatum: *Date of receipt:*	**2016.05.13**
Prüfmuster-Nr.: *Test sample No.:*	**A000359887-003**
Prüfzeitraum: *Testing period:*	**2016.05.24 to 2016.07.18**
Ort der Prüfung: *Place of testing:*	**MRT Technology(Suzhou) Co., Ltd.**
Prüflaboratorium: *Testing laboratory:*	**TÜV Rheinland (Shanghai) Co., Ltd.**
Prüfergebnis*: *Test result*:*	**Pass**



geprüft von / *tested by*:			**kontrolliert von** / *reviewed by*:		
2016.07.19	Elliot Zhang / Senior Project Engineer	Elliot Zhang	2016.07.19	Shi Li / Section Manager	SL
Datum *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*

Sonstiges / *Other*

Zustand des Prüfgegenstandes bei Anlieferung: Prüfmuster vollständig und unbeschädigt
Condition of the test item at delivery: *Test item complete and undamaged*

* Legende:	1 = sehr gut	2 = gut	3 = befriedigend	4 = ausreichend	5 = mangelhaft
	P(ass) = entspricht o.g. Prüfgrundlage(n)		F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
Legend:	*1 = very good*	*2 = good*	*3 = satisfactory*	*4 = sufficient*	*5 = poor*
	P(ass) = passed a.m. test specification(s)		*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

TEST SUMMARY

5.1.1 ANTENNA REQUIREMENT
RESULT: Pass

5.1.2 PEAK OUTPUT POWER
RESULT: Pass

5.1.3 6DB BANDWIDTH
RESULT: Pass

5.1.4 CONDUCTED SPURIOUS EMISSIONS
RESULT: Pass

5.1.5 POWER SPECTRAL DENSITY
RESULT: Pass

5.1.6 RADIATED SPURIOUS EMISSION
RESULT: Pass

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1. General Remarks

1.1 Complementary Materials

Null.

2. Test Sites

2.1 Test Facilities

MRT Technology (Suzhou) Co., Ltd.

D8 Building, Youxin Industrial Park, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China

The used test equipment is in accordance with CISPR 16 for measurement of radio interference.

The Federal Communications Commission has reviewed the technical characteristics of the radiated and conducted emission facility, and has found these test facilities to be in compliance with the requirements of section 2.948 of the FCC rules. The description of the test facility is listed under FCC registration number 809388.

The Industry Canada has reviewed the technical characteristics of the radiated and conducted emission facility, and has found these test facilities to be in compliance. The description of the test facility is listed under chambers filing number 11384A.

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Conducted Emissions

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
EMI Test Receiver	R&S	ESR7	101209	2016.11.03
Two-Line V-Network	R&S	ENV216	101683	2016.11.03
Two-Line V-Network	R&S	ENV216	101684	2016.11.03
Temperature/Humidity Meter	Yuhuaze	N/A	N/A	2016.12.20

Radiated Emission

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	E4447A	MY45300136	2016.12.08
EMI Test Receiver	R&S	ESR7	101209	2016.11.03
Preamplifier	Schwarzbeck	BBV 9721	9721-008	2017.04.16
Preamplifier	Agilent	83017A	MY53270040	2017.03.29
Loop Antenna	Schwarzbeck	FMZB1519	1519-041	2016.12.14
TRILOG Antenna	Schwarzbeck	VULB9162	9162-047	2016.11.07
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1167	2016.11.07
Broadband Horn Antenna	Schwarzbeck	BBHA9170	BBHA9170549	2017.01.04
Digital Thermometer & Hygrometer	Minggao	N/A	N/A	2016.11.30

Conducted Test Equipment

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	N9020A	MY52090106	2017.05.08
USB Wideband Power Sensor	Boonton	55006	8911	2017.05.08
Temperature/Humidity Meter	Yuhuaze	N/A	N/A	2016.12.20

Software	Version	Function
e3	V8.3.5	EMI Test Software

2.3 Traceability

All measurement equipment calibrations are traceable to NIST or where calibration is performed outside the United States, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basics using in house standards or comparisons.

2.5 Measurement Uncertainty

Table 2: Measurement Uncertainty

Measurement Type	Frequency	Uncertainty
Antenna Port Conducted Emission	< 1GHz	±0.39dB
	> 1GHz	±0.68dB
Radiated Emission	30MHz - 1GHz	±5.34dB
	> 1GHz	±5.40dB

3. General Product Information

3.1 Product Function and Intended Use

The EUT (Equipment Under Test) is a ToolSmart Illuminated Inspection Camera which use the technic of IEEE 802.11b/g/n.

For details refer to the User Manual and Circuit Diagram.

3.2 Ratings and System Details

Kind of Equipment	:	ToolSmart Illuminated Inspection Camera
Type Designation	:	TS07
Operating Frequency band	:	802.11b/g/n-HT20: 2412 ~ 2462MHz 802.11n-HT40: 2422 ~2462MHz
Channel Number	:	802.11b/g/n-HT20: 11 802.11n-HT40: 9
Modulation Type	:	802.11b: DSSS 802.11g/n: OFDM
Operation Voltage	:	DC 3.7V
Antenna 0	:	Copper Tube Antenna, Max gain 3dBi
Antenna 1	:	Copper Tube Antenna, Max gain 3dBi
Directional gain	:	6.01dBi

Note: According to the User Manual, the device can't operate during charging.

Table 3: Carrier Frequency of IEEE 802.11b/g/n-HT20

Operating Frequency Band	Channel No.	Frequency	Channel No.	Frequency
2412 – 2462 MHz	1	2412 MHz	7	2442 MHz
	2	2417 MHz	8	2447 MHz
	3	2422 MHz	9	2452 MHz
	4	2427 MHz	10	2457 MHz
	5	2432 MHz	11	2462 MHz
	6	2437 MHz		

Table 4: Carrier Frequency of IEEE 802.11n-HT40

Operating Frequency Band	Channel No.	Frequency	Channel No.	Frequency
2422 – 2452 MHz	3	2422 MHz	7	2442 MHz
	4	2427 MHz	8	2447 MHz
	5	2432 MHz	9	2452 MHz
	6	2437 MHz		

3.3 Independent Operation Modes

The basic operation modes are:

A. Transmitting
    1. Low Channel
    2. Middle Channel
    3. High Channel
B. Receiving
C. Standby
D. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.5 Submitted Documents

- Bill of Material
- PCB Layout
- Photo Document
- Circuit Diagram
- Instruction Manual
- Rating Label

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The equipment under test (EUT) was configured to measure its maximum power level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 5. All testing were performed according to the procedures in ANSI C63.10: 2013.

4.3 Special Accessories and Auxiliary Equipment

Null.

4.4 Countermeasures to achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Constructional Data Form or the Technical Construction File. No additional measures were employed to achieve compliance.

5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT: **Pass**

According to the manufacturer declared, the EUT has two same Copper Tube Antennas, the directional gain of antenna is 3dBi and the antenna is designed with unique coupling to the intentional radiator. Therefore the EUT is considered sufficient to comply with the provision.

Table 5: Antenna Requirement

FCC 15.203 – Antenna Requirement 1		
Requirement:	No antenna other than that furnished by the responsible party shall be used with the device. ☐ Use of a permanently attached antenna, or ☒ Use an antenna that uses a unique coupling to the intentional radiator.	
Results:	Antenna type: Antenna connect type:	Copper Tube Antenna I-PEX
Verdict:	PASS	

FCC 15.204 – Antenna Requirement 2	
Requirement:	An intentional radiator may be operated only with the antenna with which it is authorized. If an antenna is marketed with the intentional radiator, it shall be of a type which is authorized with the intentional radiator.
Results:	Only one type antenna can be used
Verdict:	PASS

5.1.2 Peak Output Power

RESULT: **Pass**

Date of testing	:	2016.07.14
Test standard	:	FCC Part 15.247(b)(3)
Test procedure	:	ANSI C63.10: 2013 Clause 9.1 of KDB 558074 D01 v03r05
Limit	:	FCC Part 15.247(b)(3)
Kind of test site	:	Shielded room

Test setup

Test Channel	:	Low/ Middle/ High
Operation Mode	:	A.1; A.2; A.3
Ambient temperature	:	25℃
Relative humidity	:	52%
Atmospheric pressure	:	101kPa

Table 6: Peak Output Power

Mode	Freq. [MHz]	Maximum Conducted (peak) Output Power [dBm]	Maximum Conducted (average) Output Power [dBm]	Limit [dBm]
Ant 0				
11b	**2412**	**13.27**	**9.63**	**30**
	2437	13.04	9.40	30
	2462	13.04	9.40	30
11g	2412	18.10	9.38	30
	2437	18.24	9.57	30
	2462	18.20	9.44	30
11n-HT20	2412	18.11	9.27	30
	2437	18.02	9.42	30
	2462	18.21	9.33	30
11n-HT40	2422	17.83	8.55	30
	2437	18.33	9.45	30
	2452	17.82	8.86	30
Ant 1				
11b	2412	13.18	9.45	30
	2437	13.17	9.43	30
	2462	13.19	9.44	30
11g	2412	18.09	9.36	30
	2437	18.03	9.58	30
	2462	18.09	9.45	30
11n-HT20	2412	17.88	9.23	30
	2437	18.22	9.51	30

	2462	18.12	9.33	30
11n-HT40	2422	17.76	8.76	30
	2437	18.10	9.36	30
	2452	18.03	9.29	30

Mode	Freq. [MHz]	Maximum Conducted (peak) Output Power [dBm]			Maximum Conducted (average) Output Power [dBm]			Limit [dBm]
		Ant 0	Ant 1	Ant 0+1	Ant 0	Ant 1	Ant 0+1	
11n-HT20	2412	15.76	15.84	18.81	6.30	6.57	9.45	30
	2437	16.03	15.96	19.01	6.47	6.50	9.50	30
	2462	15.90	15.80	18.86	6.49	6.43	9.47	30
11n-HT40	2422	17.04	16.92	19.99	6.25	6.80	9.54	30
	2437	17.00	16.54	19.79	6.23	6.66	9.46	30
	2452	17.18	16.64	19.93	6.33	6.70	9.53	30

Note: The output power at each antenna will automatically reduce while using the dual antennas simultaneity.

5.1.3 6dB Bandwidth

RESULT: **Pass**

Date of testing : 2016.07.14
Test standard : FCC Part 15.247(a)(2)
Test procedure : ANSI C63.10: 2013
Clause 8 of KDB 558074 D01 v03r05
Limit : FCC Part 15.247(a)(2)
Kind of test site : Shielded room

Test setup

Test Channel : Low/ Middle/ High
Operation Mode : A.1; A.2; A.3
Ambient temperature : 25℃
Relative humidity : 52%
Atmospheric pressure : 101kPa

Table 7: 6dB Bandwidth

Mode	Frequency [MHz]	6dB Bandwidht [MHz]	Limit [kHz]
Ant 0			
11b	2412	12.327	500
	2437	12.306	500
	2462	12.307	500
11g	2412	16.508	500
	2437	16.517	500
	2462	16.510	500
11n-HT20	2412	17.581	500
	2437	17.583	500
	2462	17.581	500
11n-HT40	2422	36.232	500
	2437	36.222	500
	2452	36.235	500
Ant 1			
11b	2412	12.260	500
	2437	12.250	500
	2462	12.241	500
11g	2412	16.504	500
	2437	16.509	500
	2462	16.520	500
11n-HT20	2412	17.581	500
	2437	17.584	500
	2462	17.582	500
11n-HT40	2422	36.223	500
	2437	36.230	500
	2452	36.220	500

Ant 0+1			
11n-HT20	2412	17.570	500
	2437	17.575	500
	2462	17.579	500
11n-HT40	2422	36.211	500
	2437	36.216	500
	2452	36.225	500

Figure 1: 6dB Bandwidth, Ant 0, 11b, 2412MHz

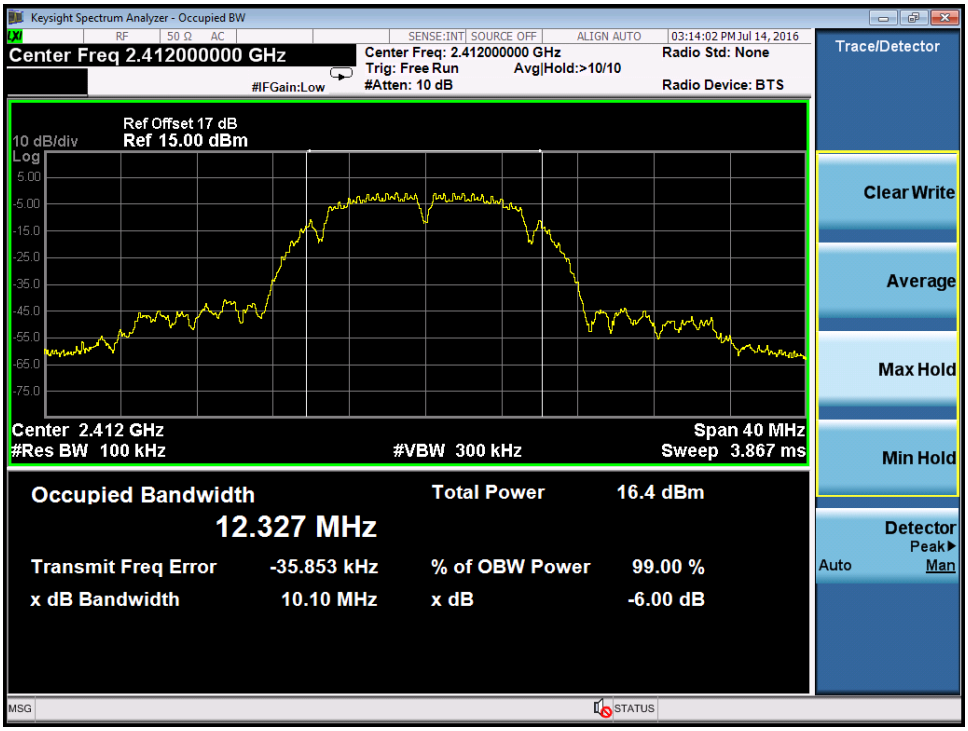


Figure 2: 6dB Bandwidth, Ant 0, 11b, 2437MHz

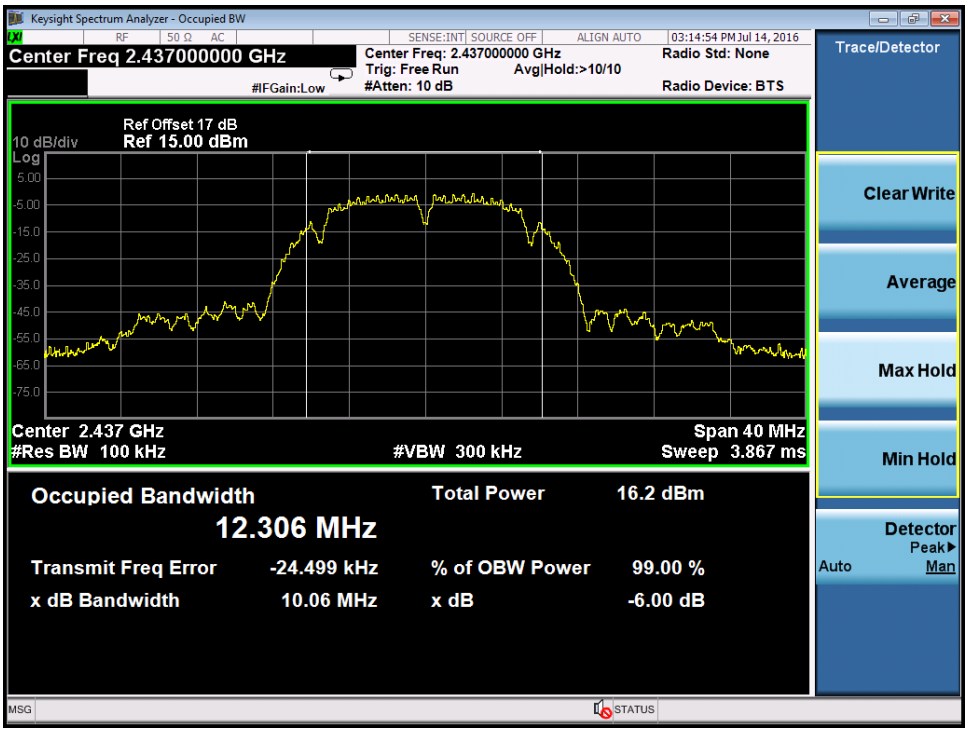


Figure 3: 6dB Bandwidth, Ant 0, 11b, 2462MHz

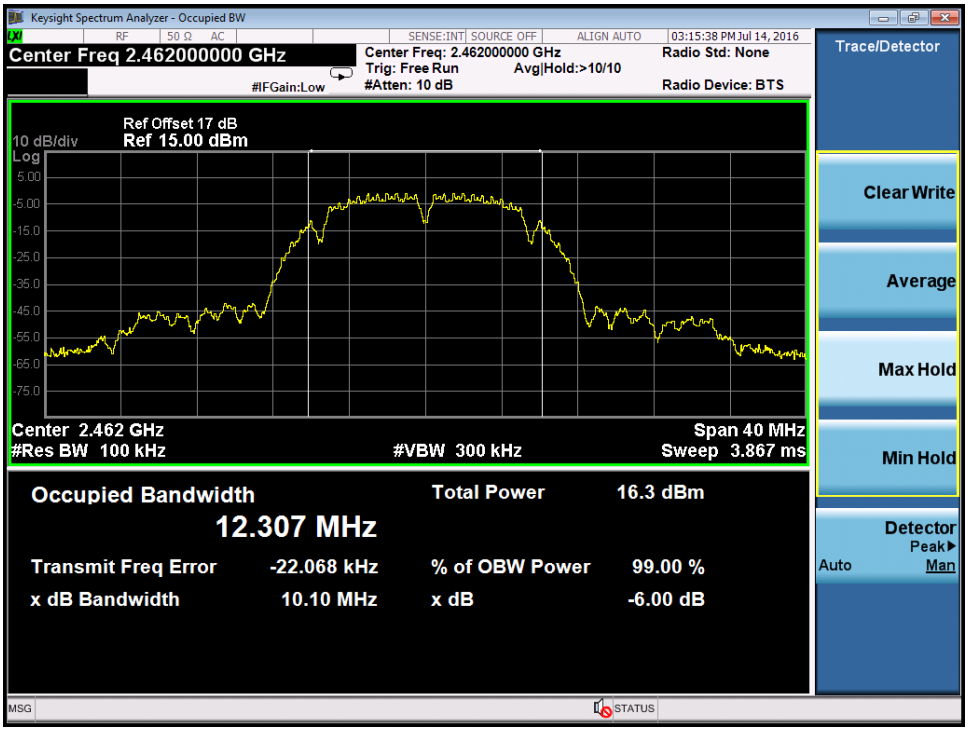


Figure 4: 6dB Bandwidth, Ant 0, 11g, 2412MHz

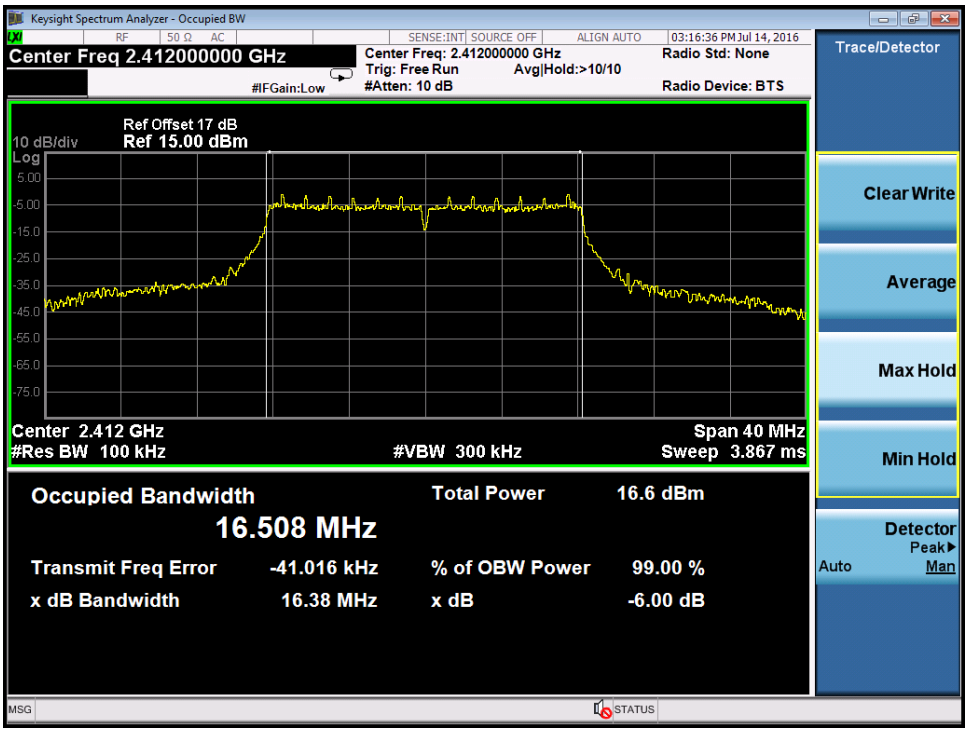


Figure 5: 6dB Bandwidth, Ant 0, 11g, 2437MHz

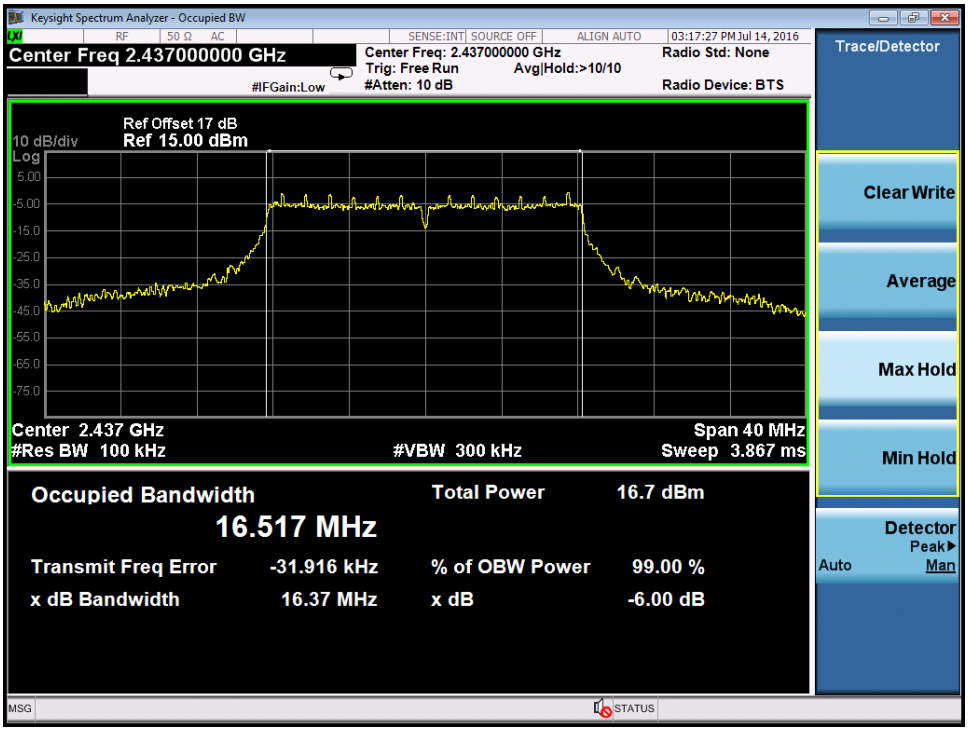


Figure 6: 6dB Bandwidth, Ant 0, 11g, 2462MHz

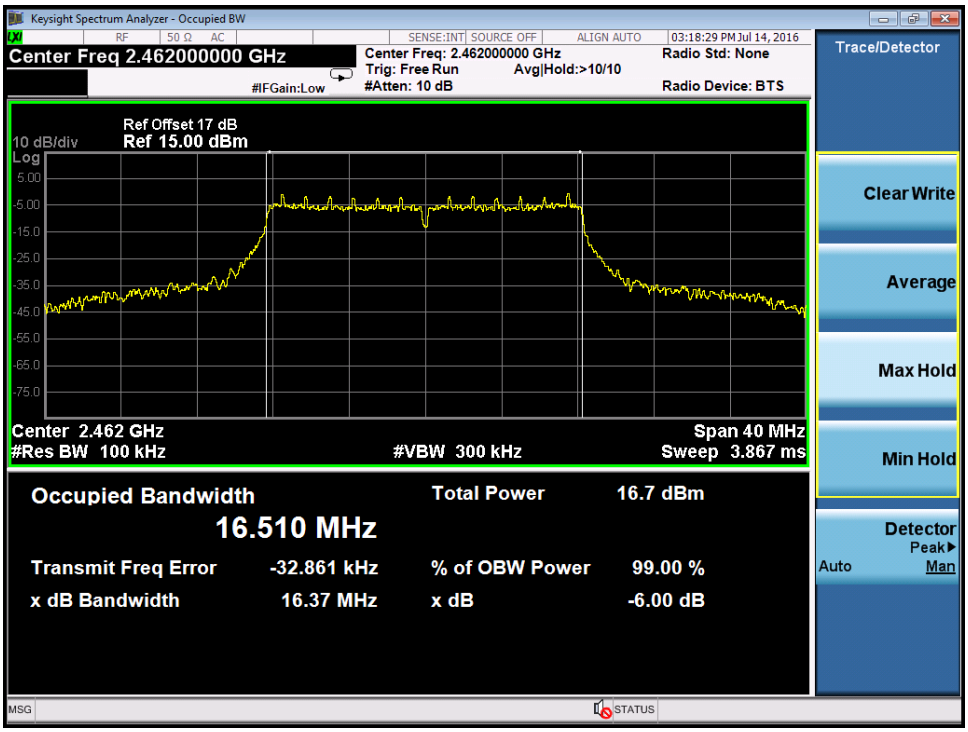


Figure 7: 6dB Bandwidth, Ant 0, 11n-HT20, 2412MHz

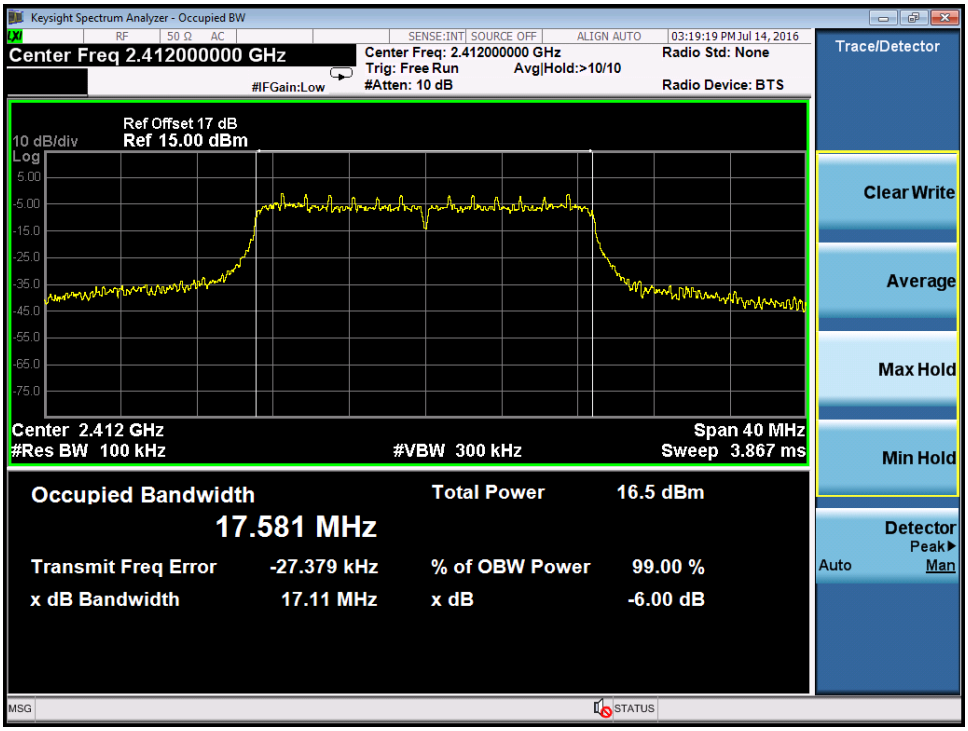


Figure 8: 6dB Bandwidth, Ant 0, 11n-HT20, 2437MHz

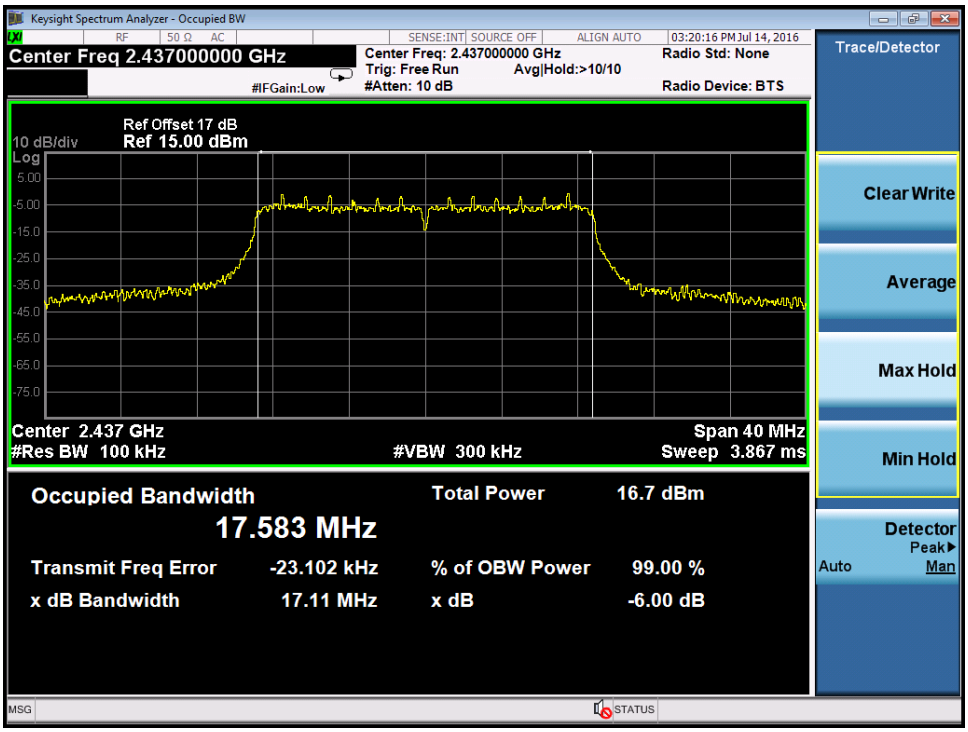


Figure 9: 6dB Bandwidth, Ant 0, 11n-HT20, 2462MHz

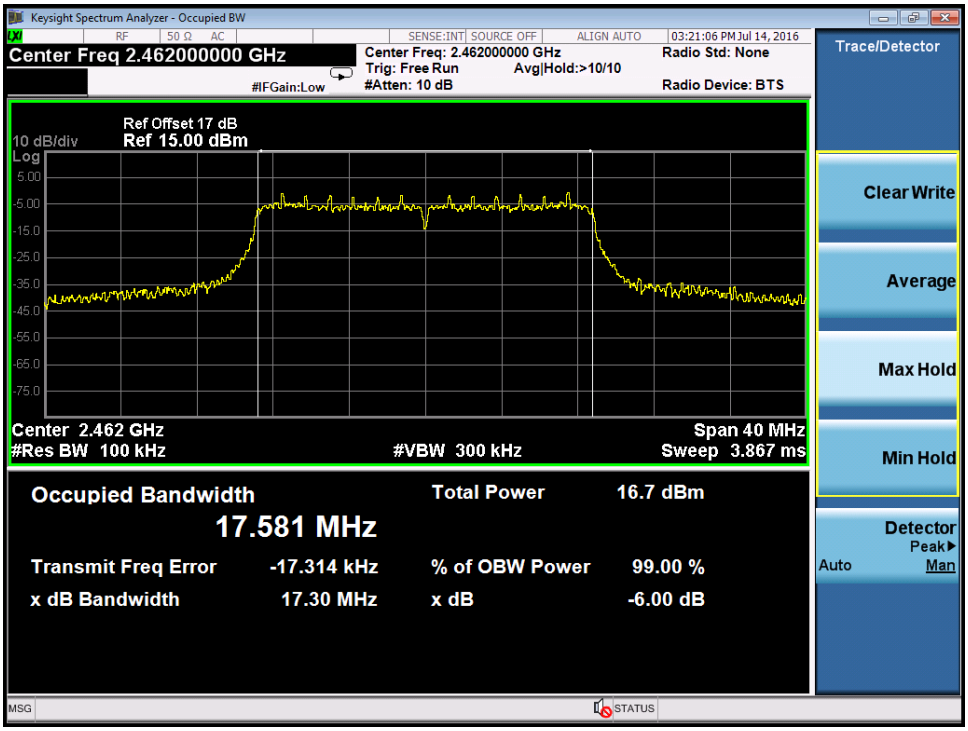


Figure 10: 6dB Bandwidth, Ant 0, 11n-HT40, 2422MHz

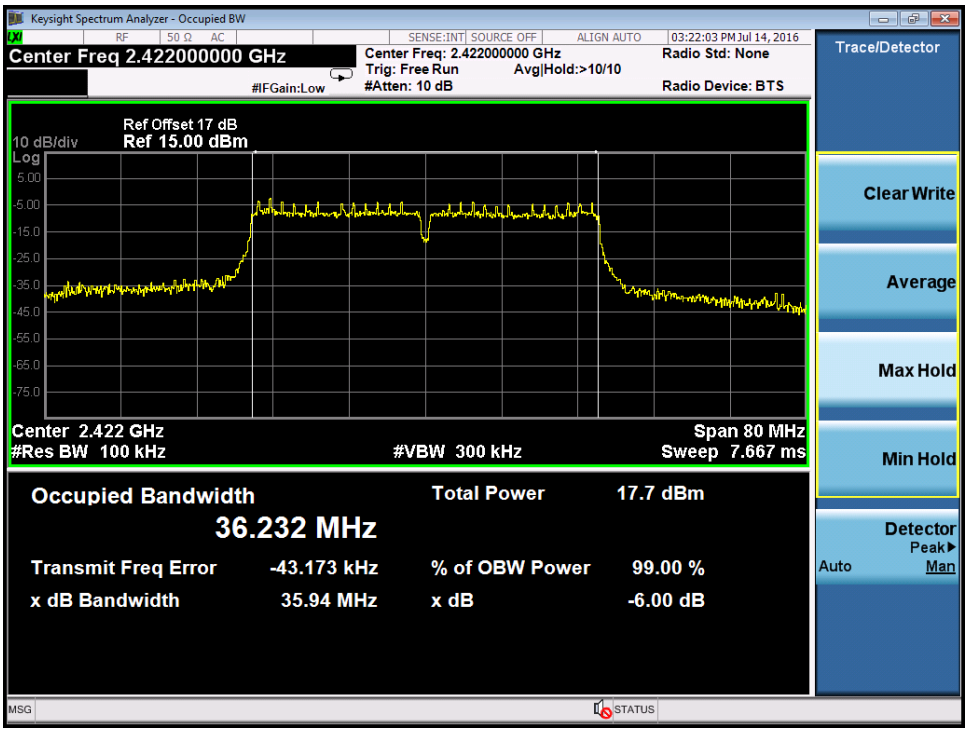


Figure 11: 6dB Bandwidth, Ant 0, 11n-HT40, 2437MHz

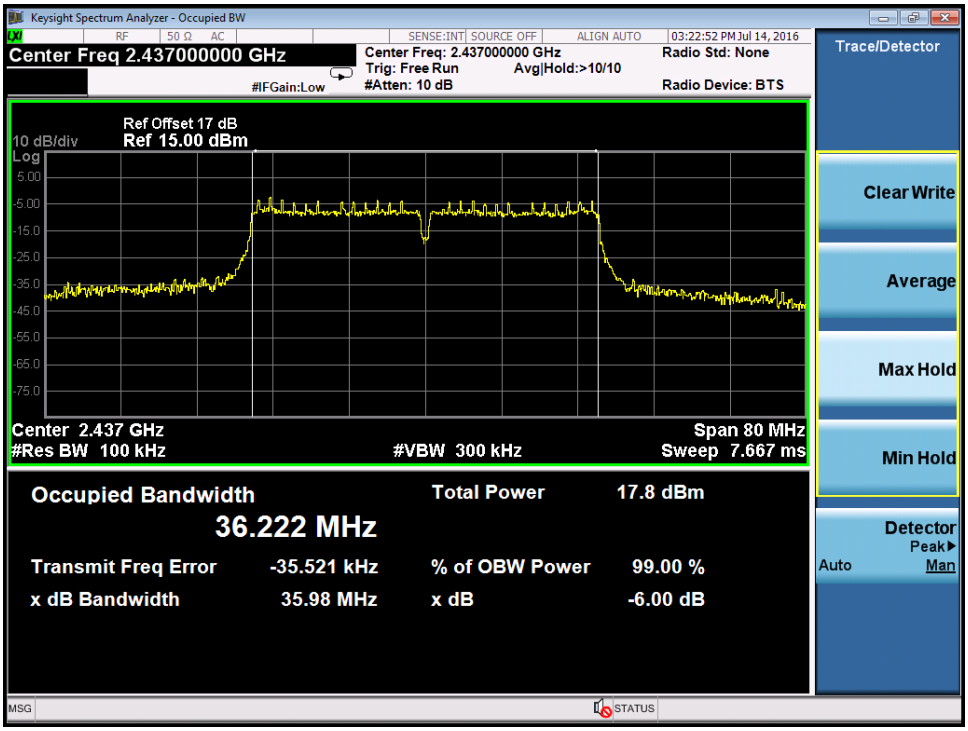


Figure 12: 6dB Bandwidth, Ant 0, 11n-HT40, 2452MHz

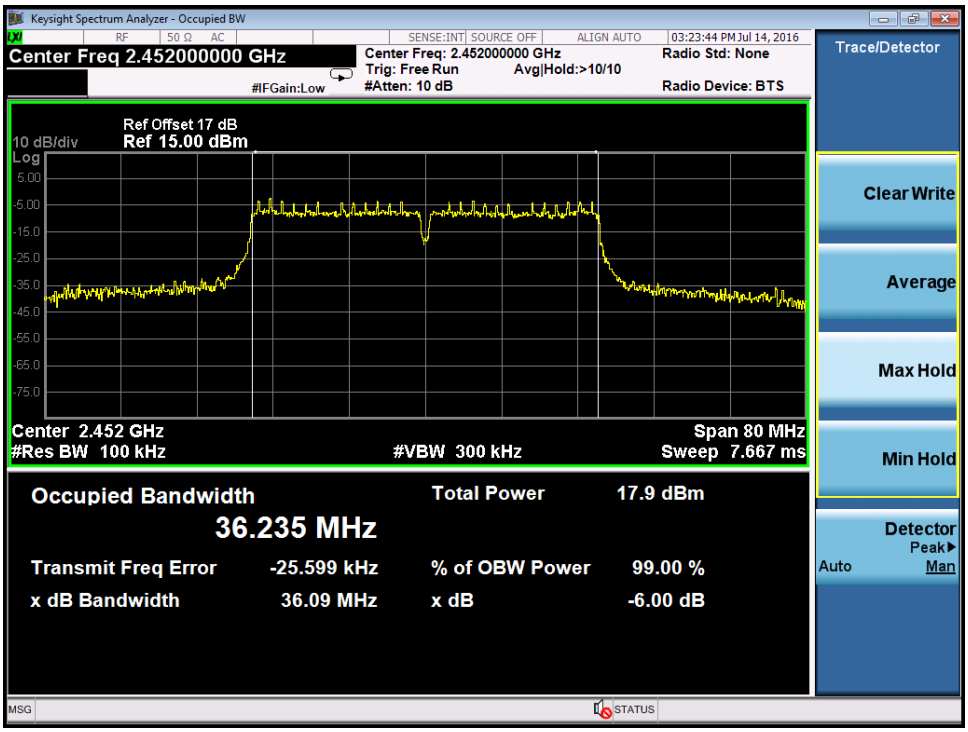


Figure 13: 6dB Bandwidth, Ant 1, 11b, 2412MHz

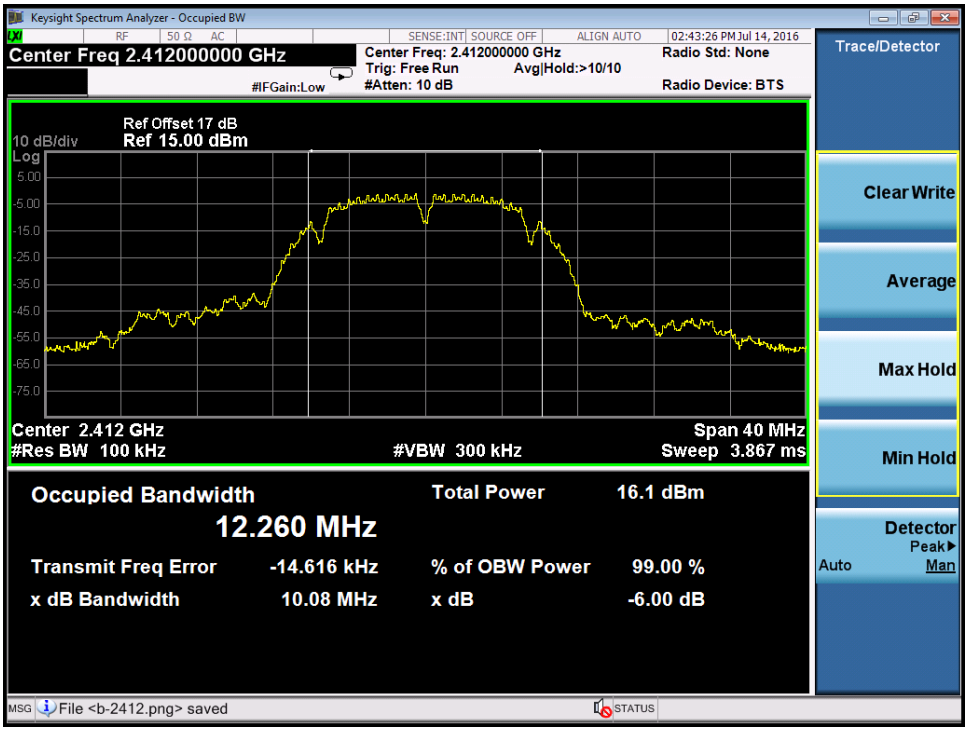


Figure 14: 6dB Bandwidth, Ant 1, 11b, 2437MHz

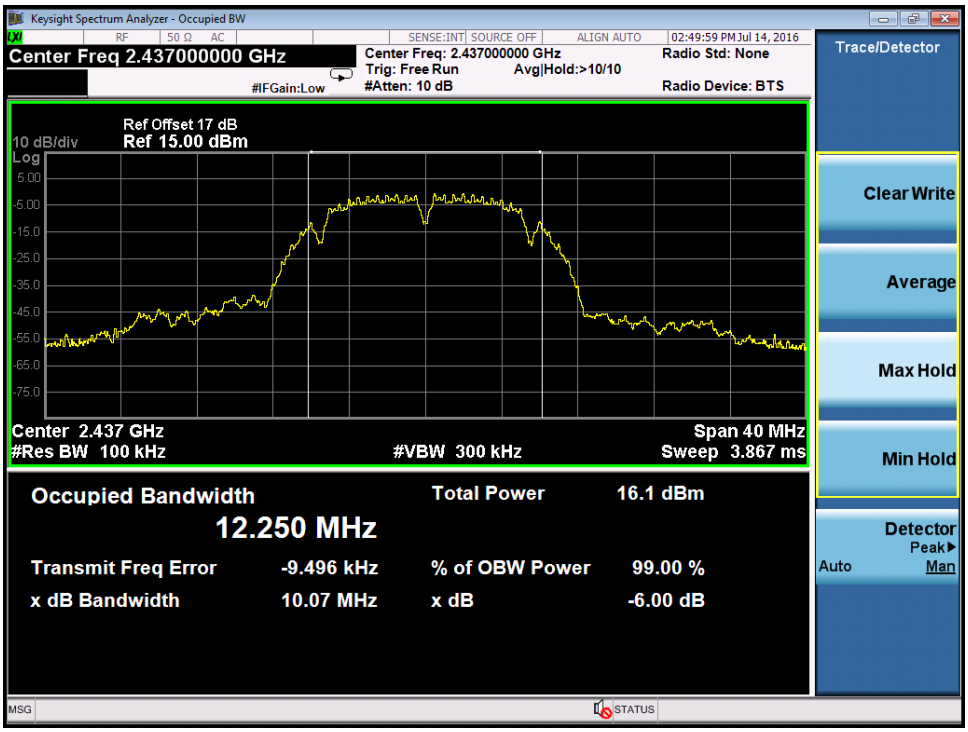


Figure 15: 6dB Bandwidth, Ant 1, 11b, 2462MHz

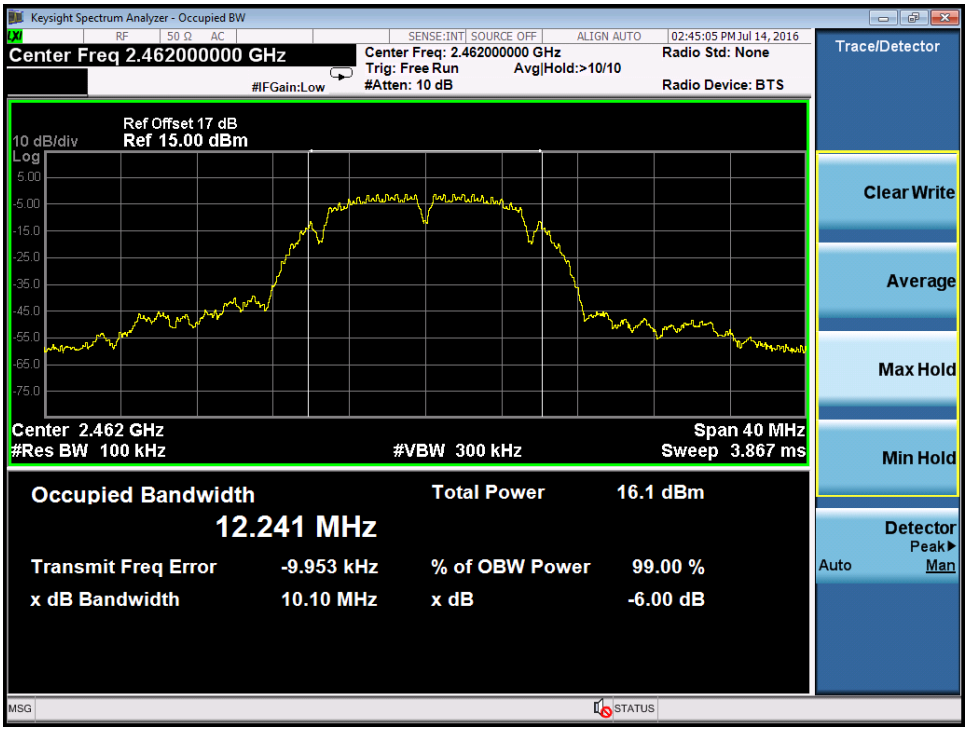


Figure 16: 6dB Bandwidth, Ant 1, 11g, 2412MHz

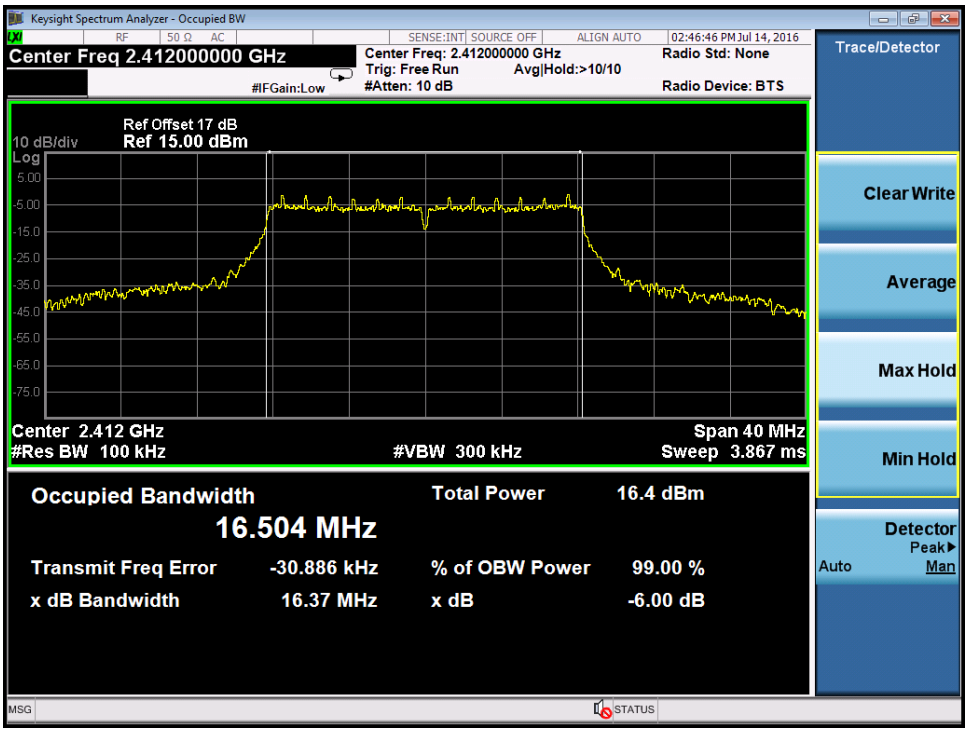


Figure 17: 6dB Bandwidth, Ant 1, 11g, 2437MHz

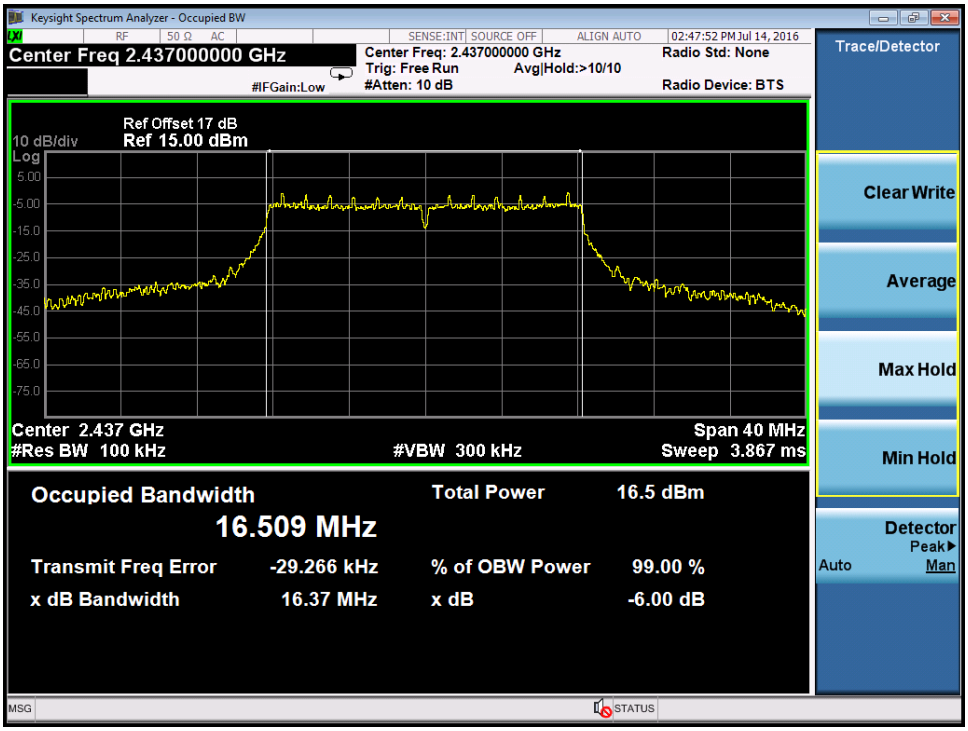


Figure 18: 6dB Bandwidth, Ant 1, 11g, 2462MHz

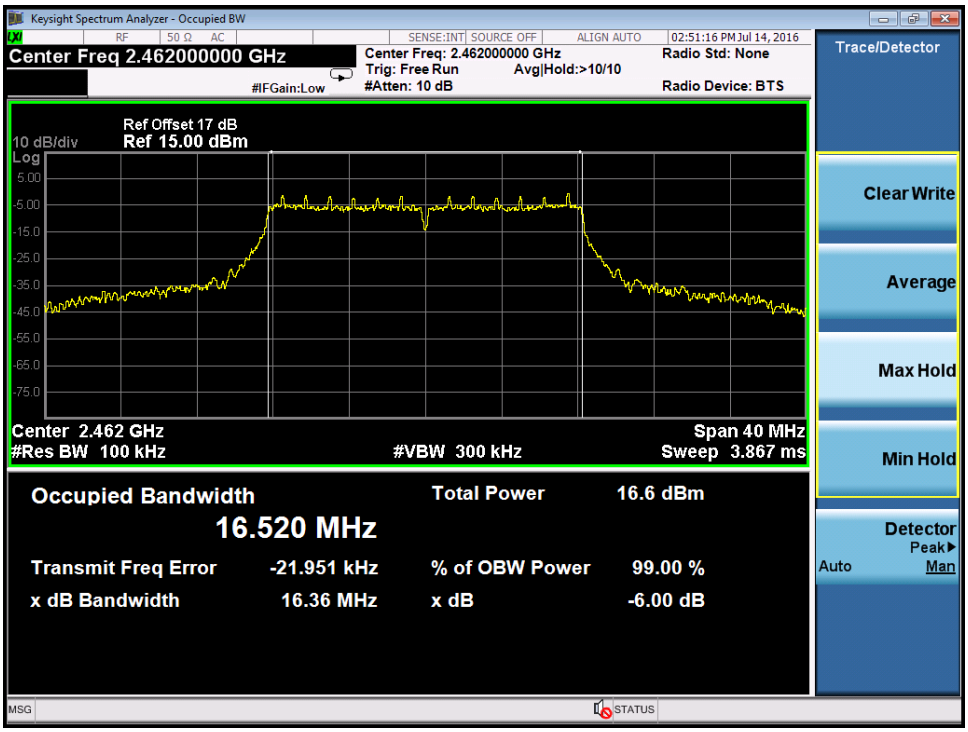


Figure 19: 6dB Bandwidth, Ant 1, 11n-HT20, 2412MHz

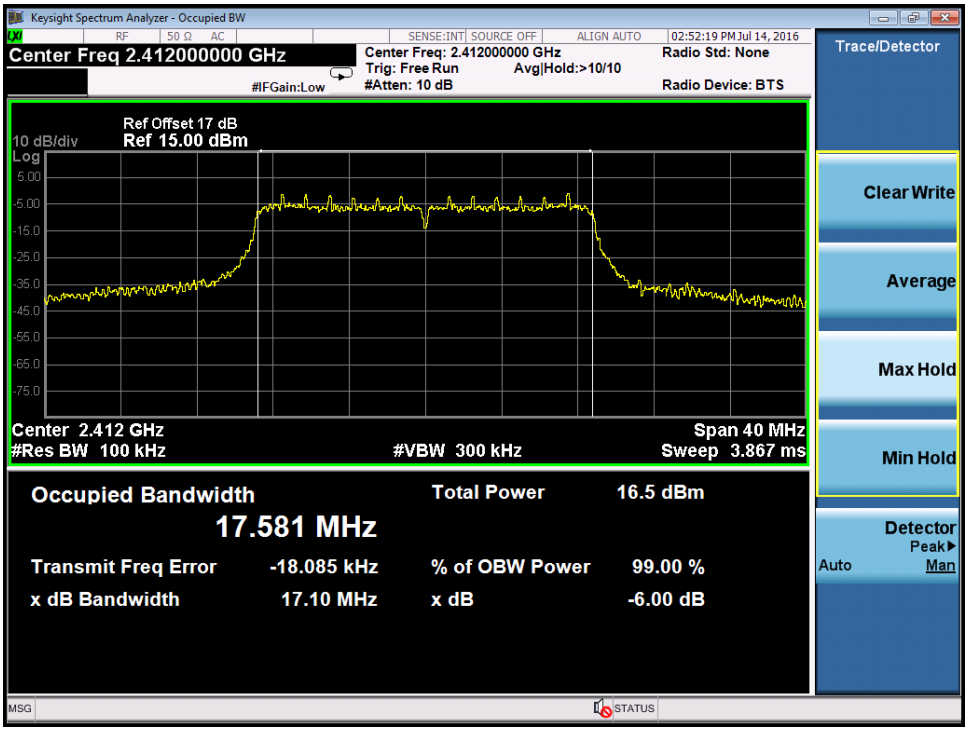


Figure 20: 6dB Bandwidth, Ant 1, 11n-HT20, 2437MHz

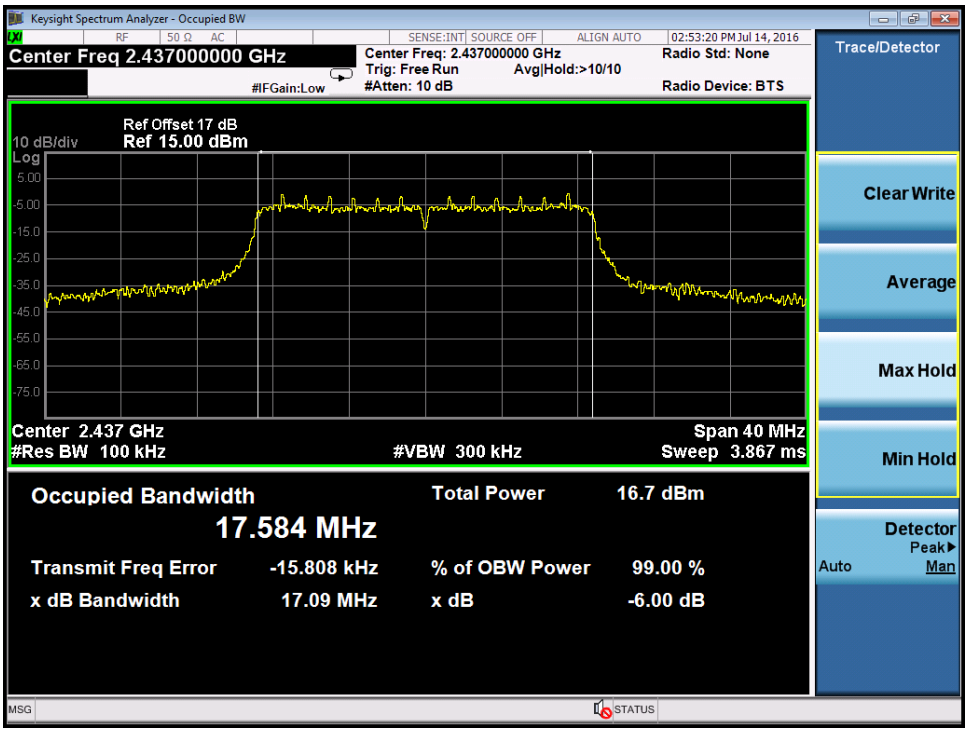


Figure 21: 6dB Bandwidth, Ant 1, 11n-HT20, 2462MHz

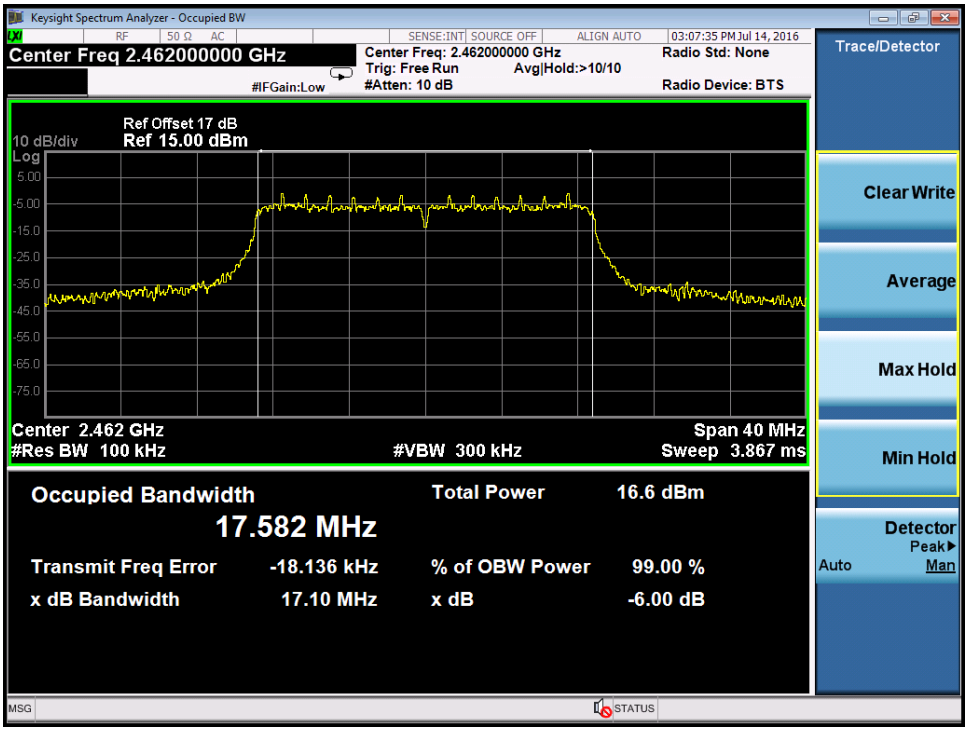


Figure 22: 6dB Bandwidth, Ant 1, 11n-HT40, 2422MHz

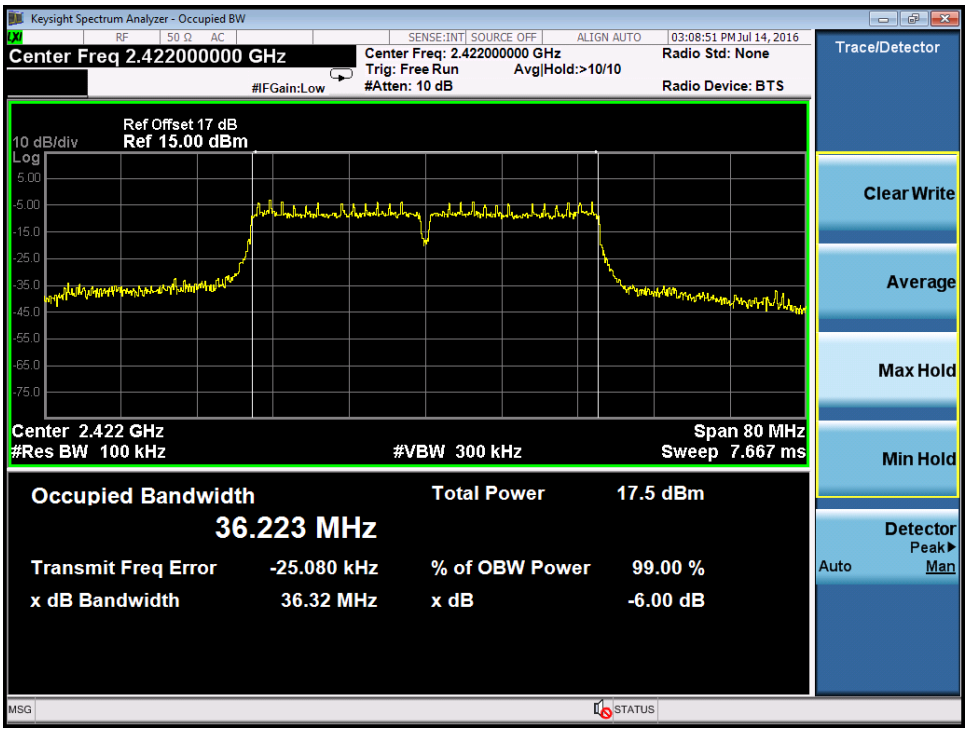


Figure 23: 6dB Bandwidth, Ant 1, 11n-HT40, 2437MHz

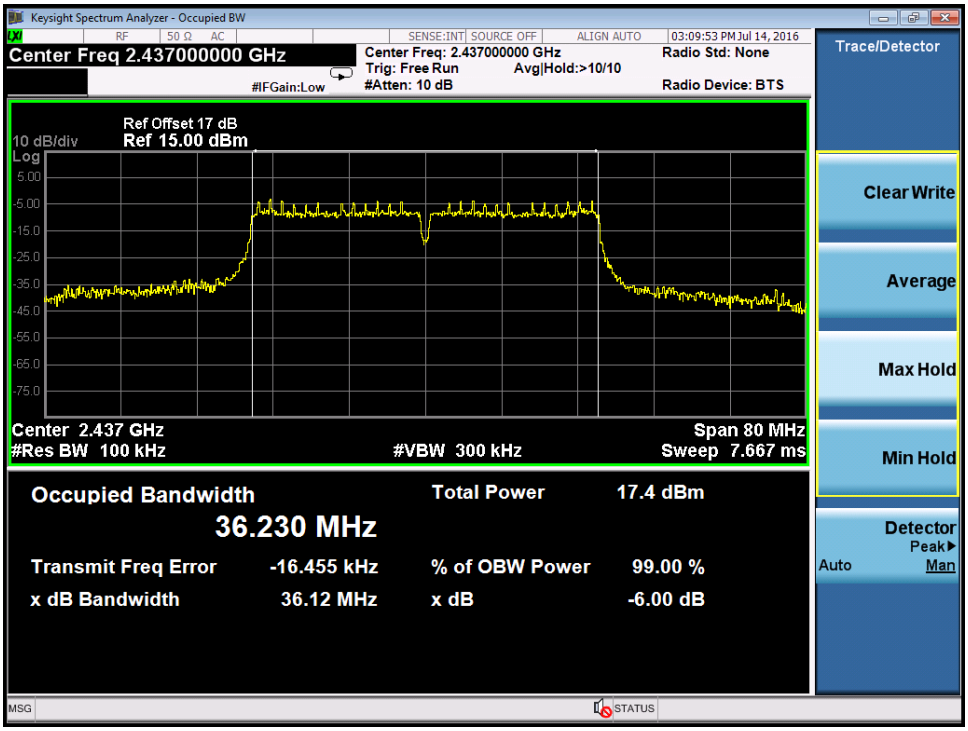


Figure 24: 6dB Bandwidth, Ant 1, 11n-HT40, 2452MHz

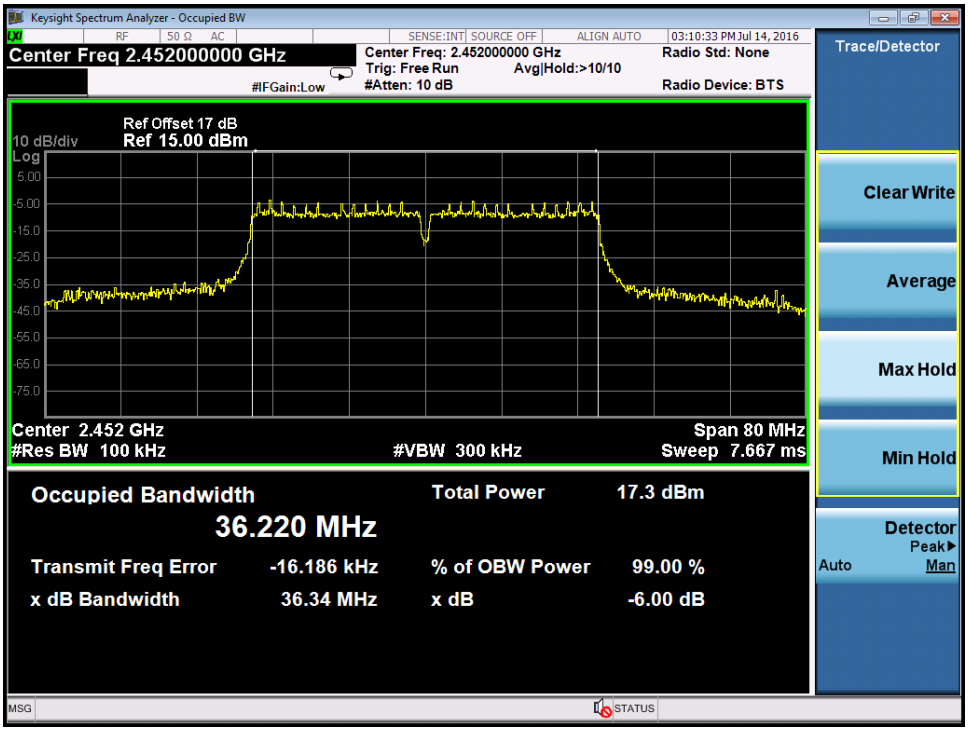


Figure 25: 6dB Bandwidth, Ant 0+1, 11n-HT20, 2412MHz

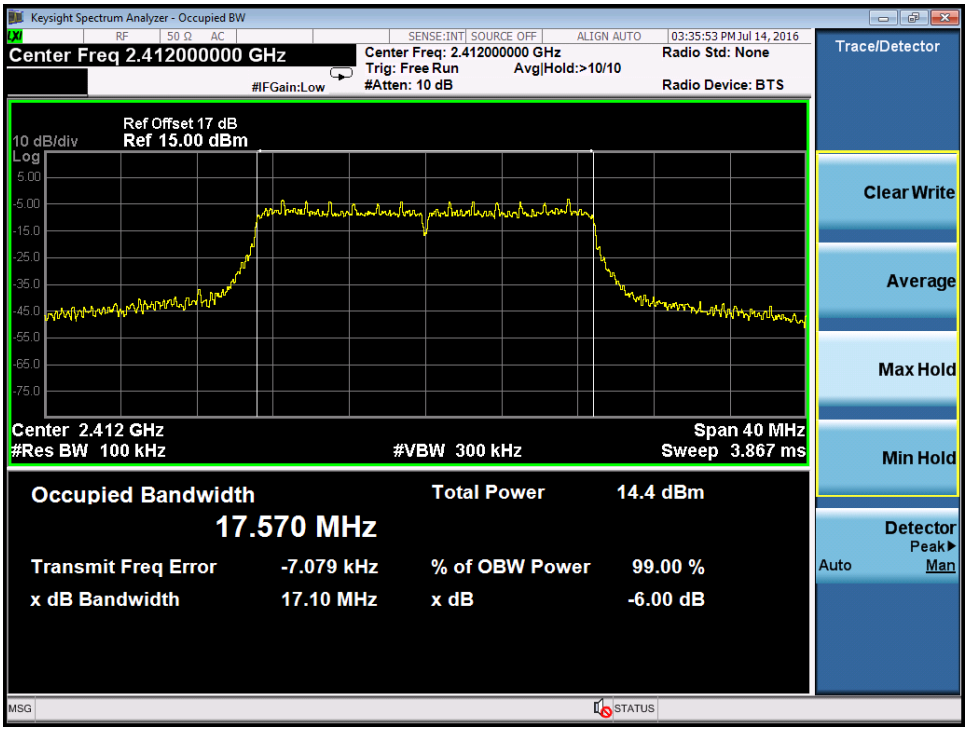


Figure 26: 6dB Bandwidth, Ant 0+1, 11n-HT20, 2437MHz

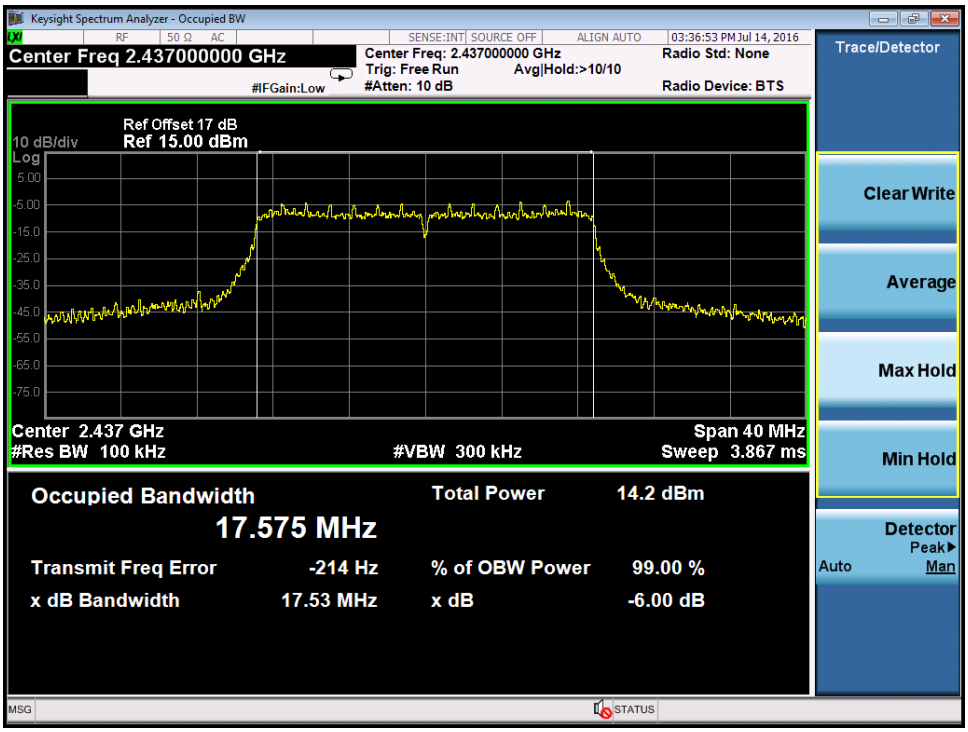


Figure 27: 6dB Bandwidth, Ant 0+1, 11n-HT20, 2462MHz

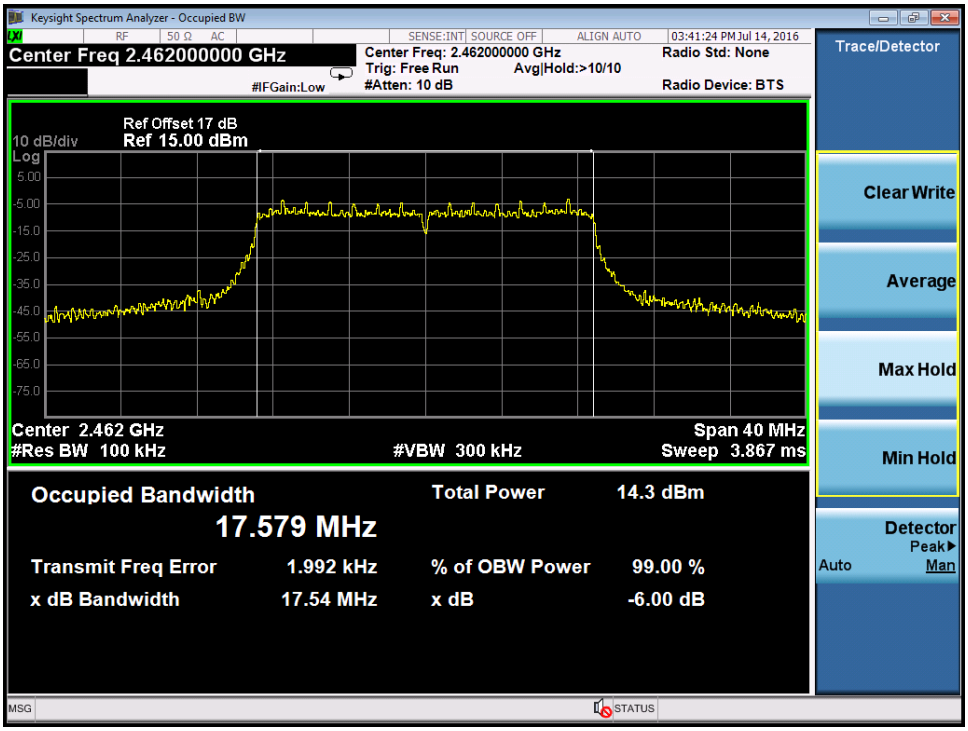


Figure 28: 6dB Bandwidth, Ant 0+1, 11n-HT40, 2422MHz

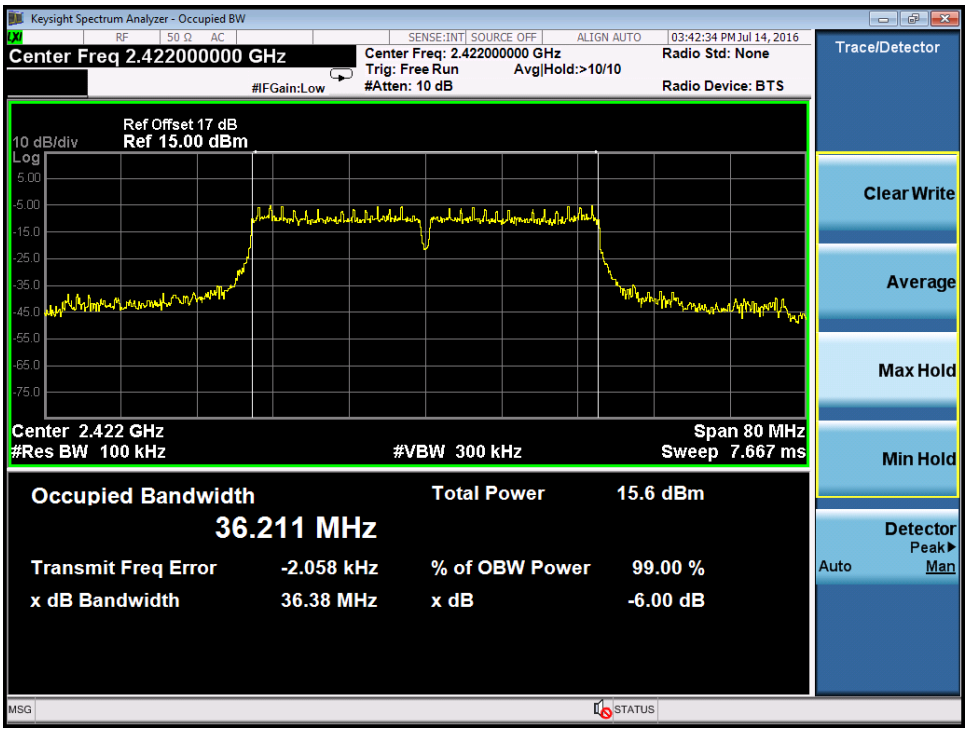


Figure 29: 6dB Bandwidth, Ant 0+1, 11n-HT40, 2437MHz

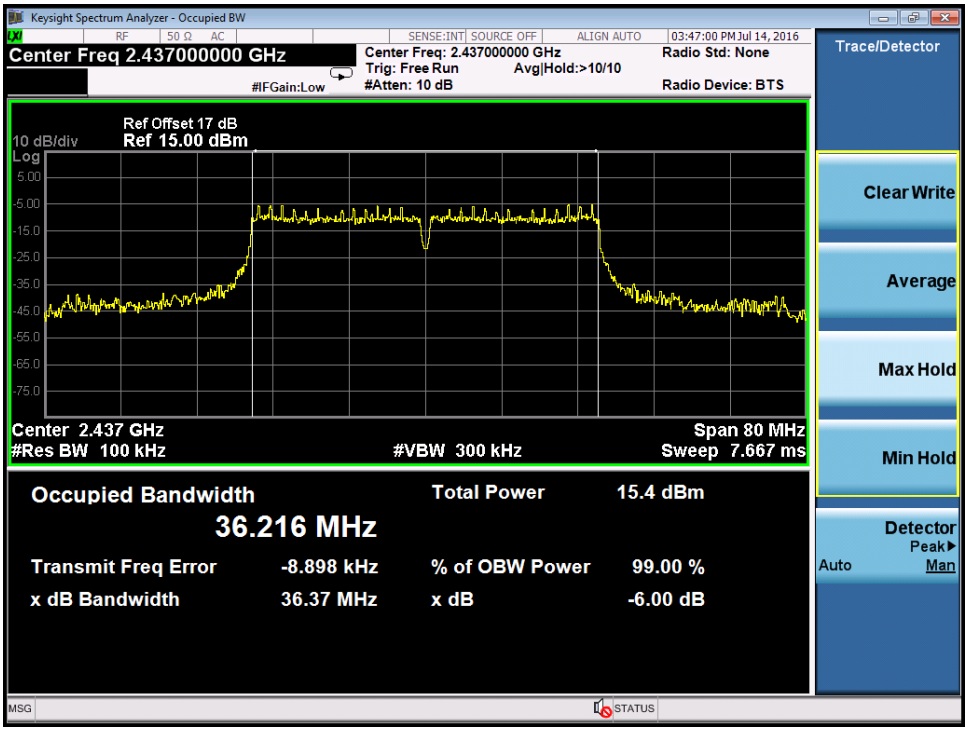
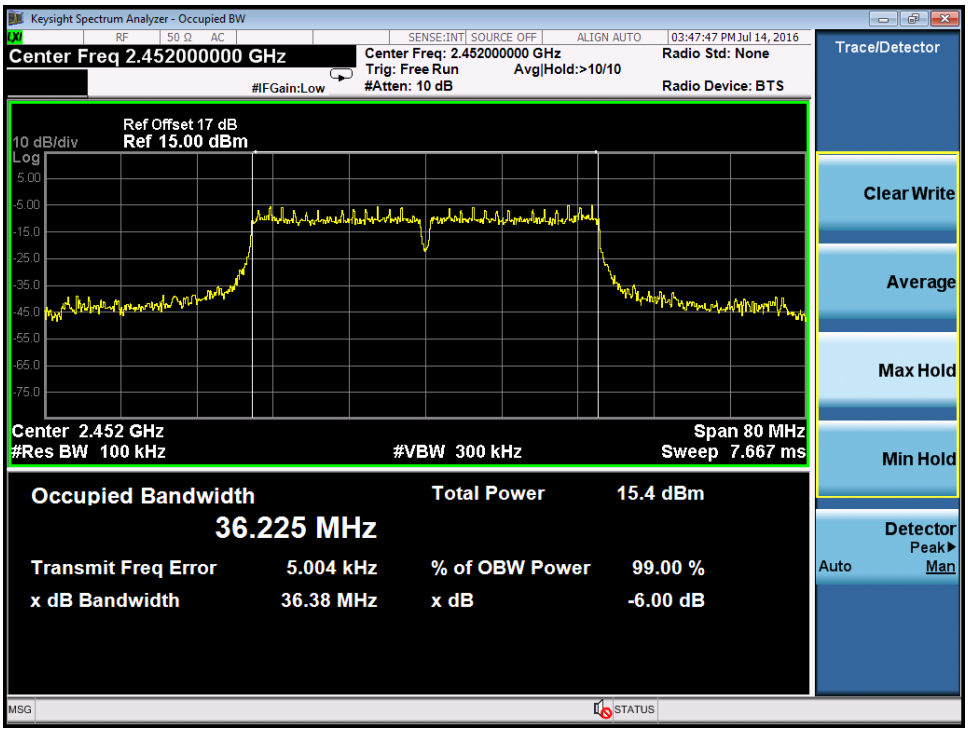


Figure 30: 6dB Bandwidth, Ant 0+1, 11n-HT40, 2452MHz



5.1.4 Conducted Spurious Emissions

RESULT: **Pass**

Date of testing	:	2016.07.15
Test standard	:	FCC Part 15.247(d)
Test procedure	:	ANSI C63.10: 2013
Limit	:	FCC Part 15.247(d)
Kind of test site	:	Shielded room

Test setup

Test Channel	:	Low/ Middle/ High
Operation Mode	:	A.1; A.2; A.3
Ambient temperature	:	25℃
Relative humidity	:	52%
Atmospheric pressure	:	101kPa

Figure 31: Conducted Spurious Emission, Ant 0, 11b, 2412MHz

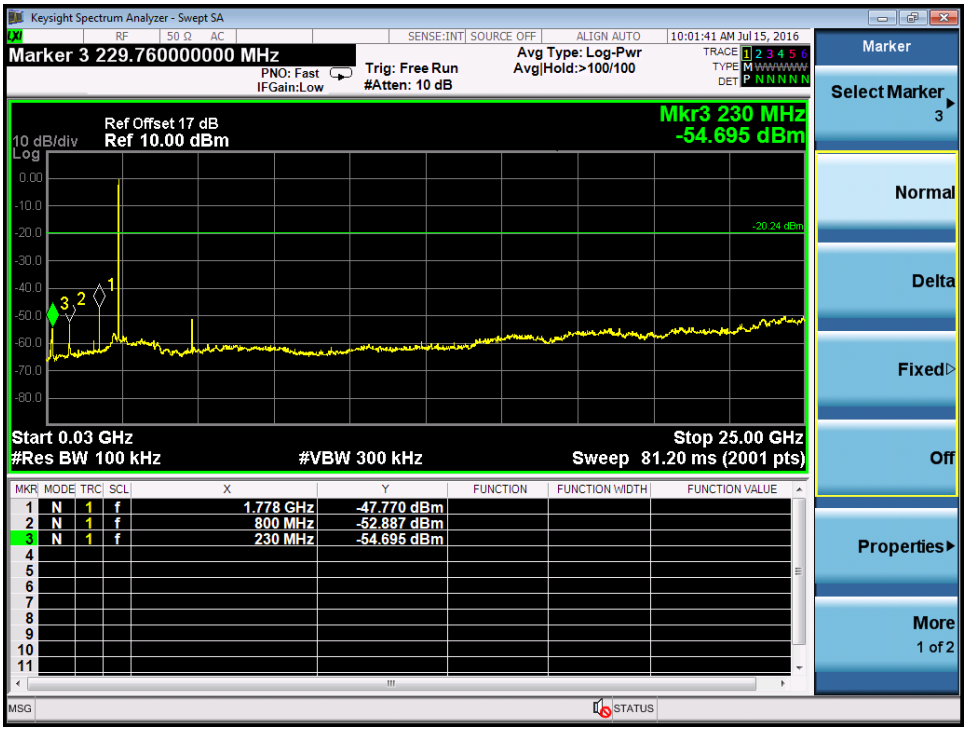


Figure 32: Conducted Spurious Emission, Ant 0, 11b, 2437MHz

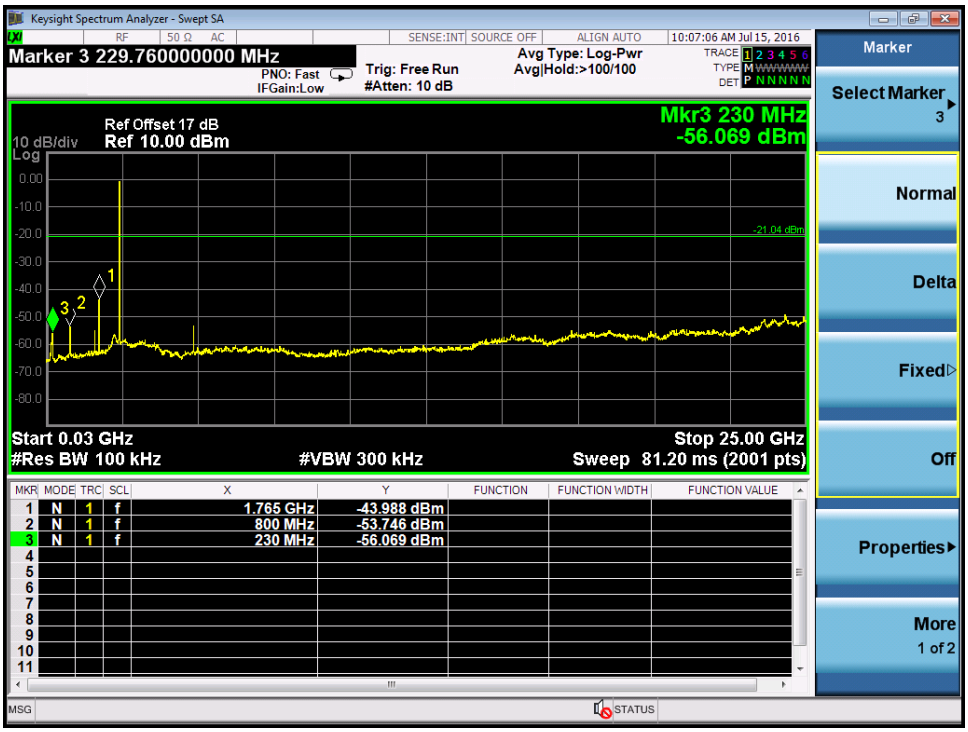


Figure 33: Conducted Spurious Emission, Ant 0, 11b, 2462MHz

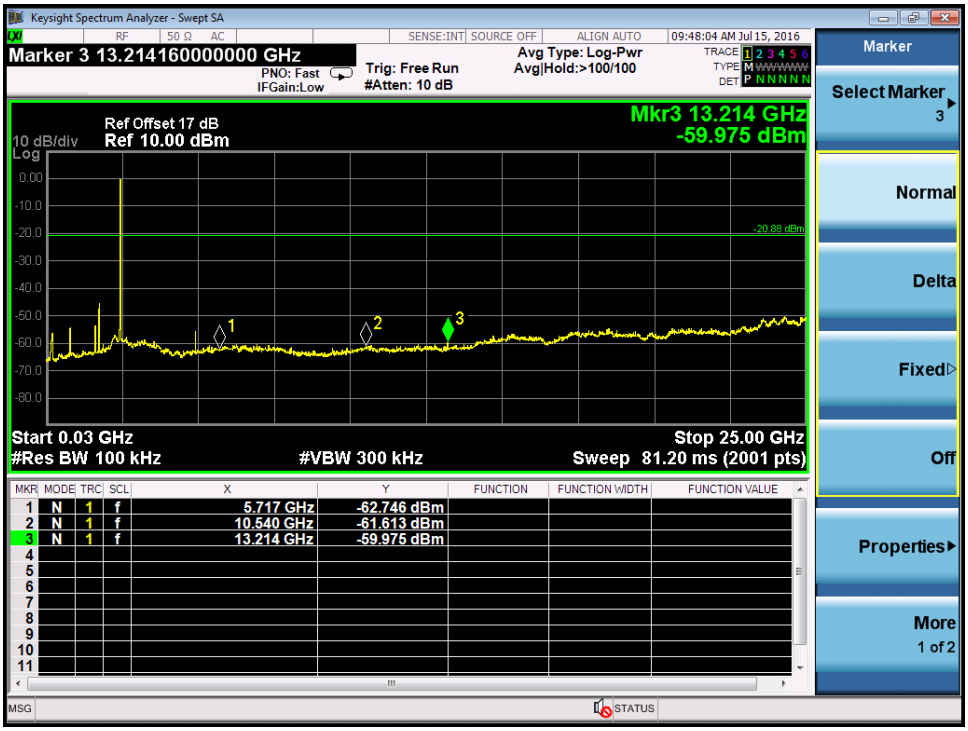


Figure 34: Conducted Spurious Emission, Ant 0, 11g, 2412MHz

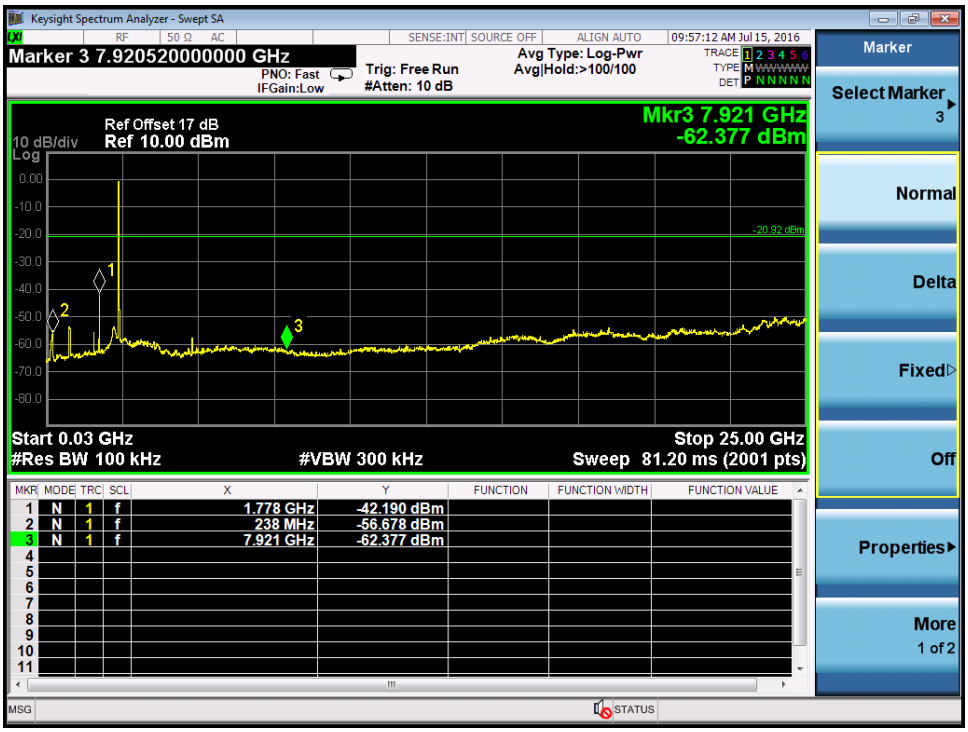


Figure 35: Conducted Spurious Emission, Ant 0, 11g, 2437MHz

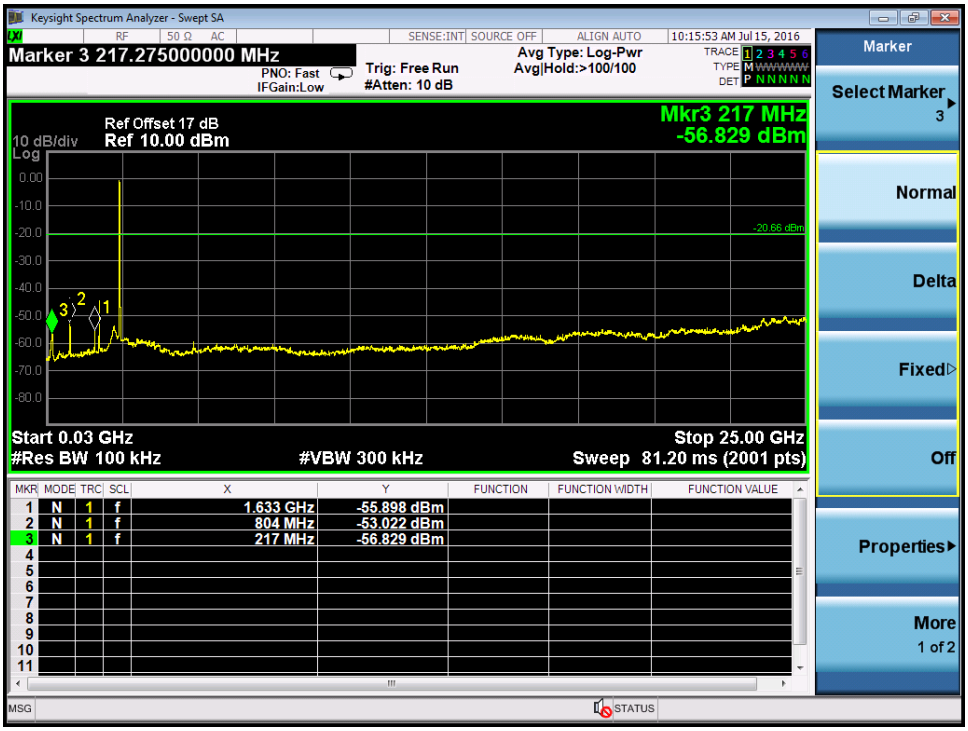


Figure 36: Conducted Spurious Emission, Ant 0, 11g, 2462MHz

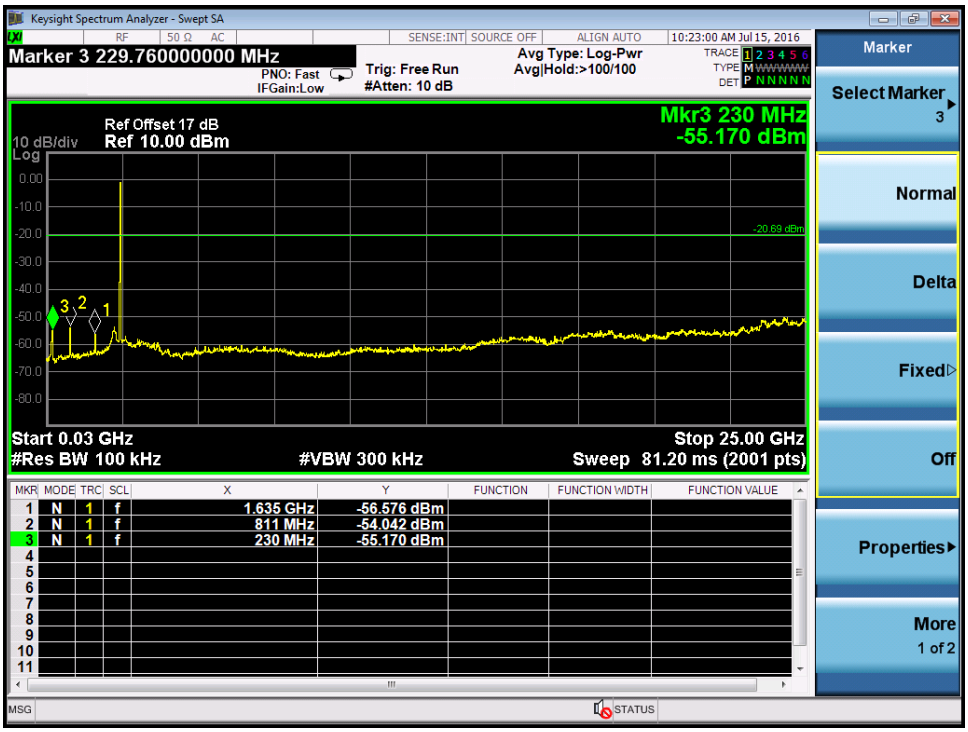


Figure 37: Conducted Spurious Emission, Ant 0, 11n-HT20, 2412MHz

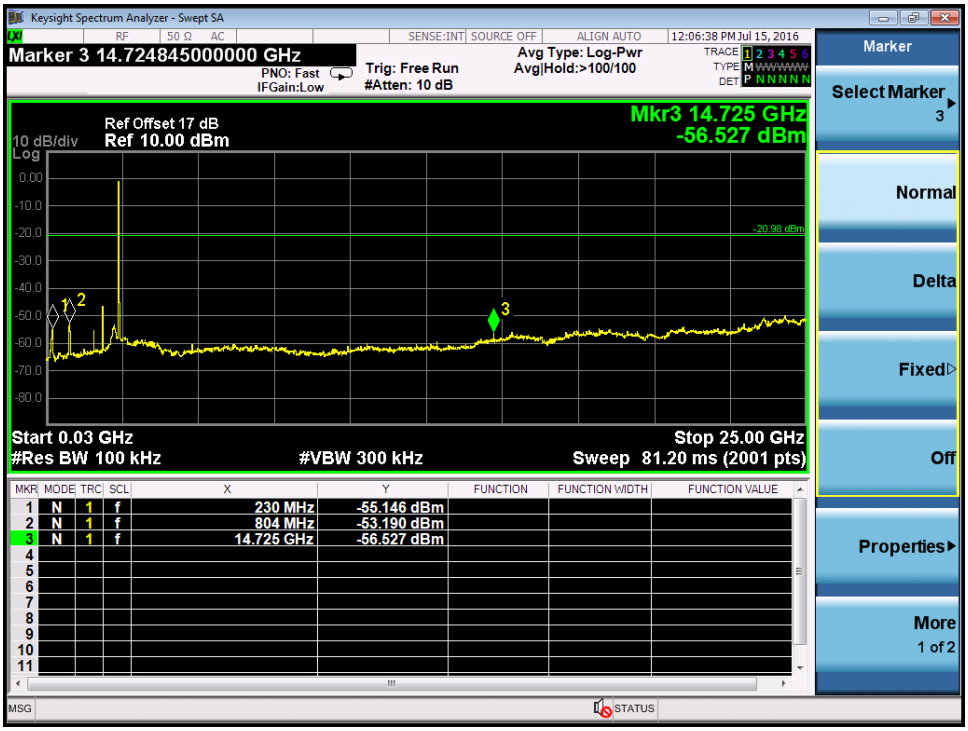


Figure 38: Conducted Spurious Emission, Ant 0, 11n-HT20, 2437MHz

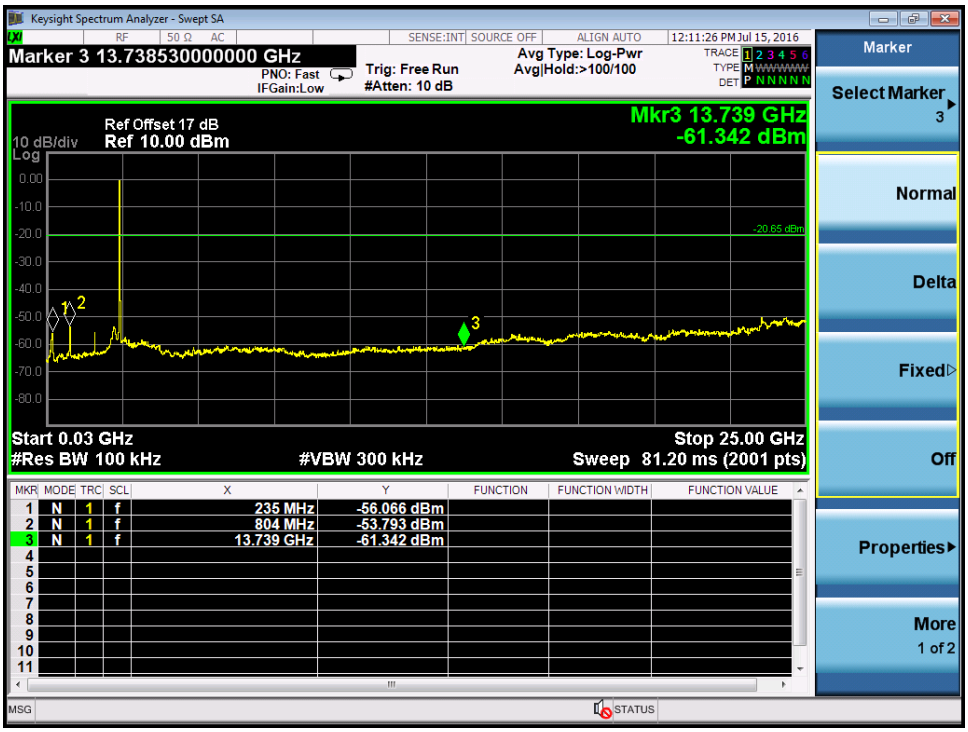


Figure 39: Conducted Spurious Emission, Ant 0, 11n-HT20, 2462MHz

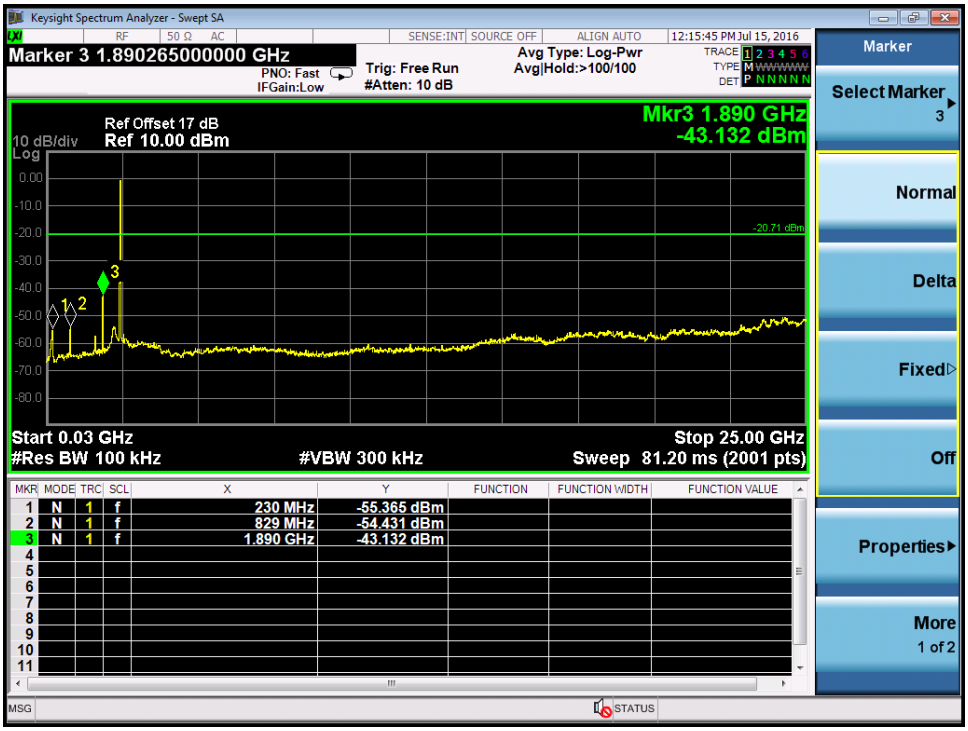


Figure 40: Conducted Spurious Emission, Ant 0, 11n-HT40, 2422MHz

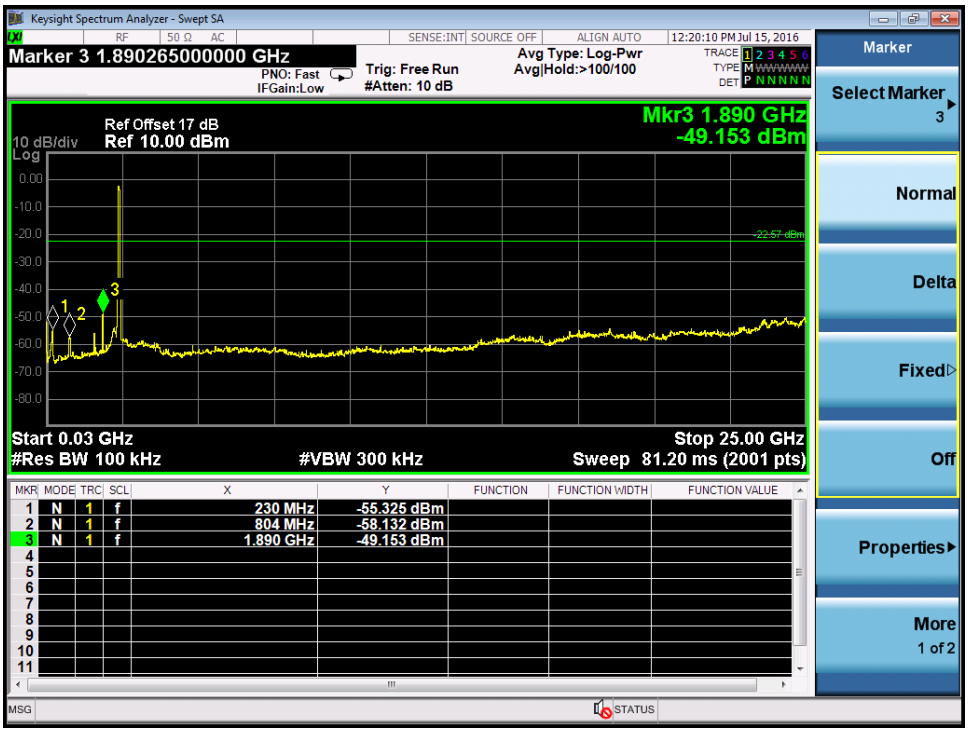


Figure 41: Conducted Spurious Emission, Ant 0, 11n-HT40, 2437MHz

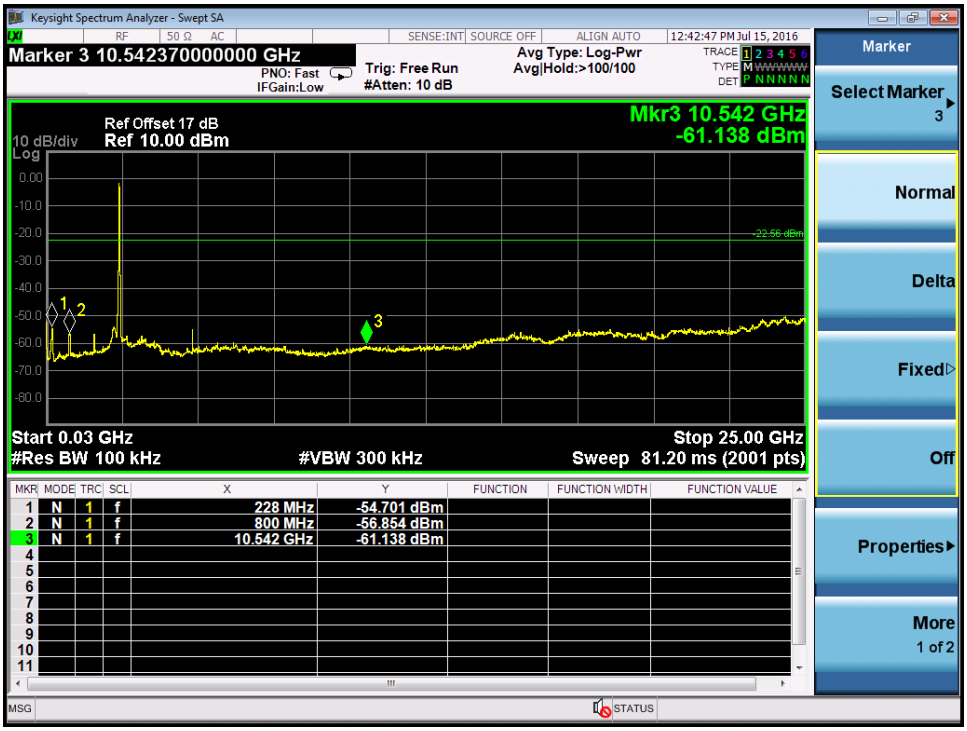


Figure 42: Conducted Spurious Emission, Ant 0, 11n-HT40, 2452MHz

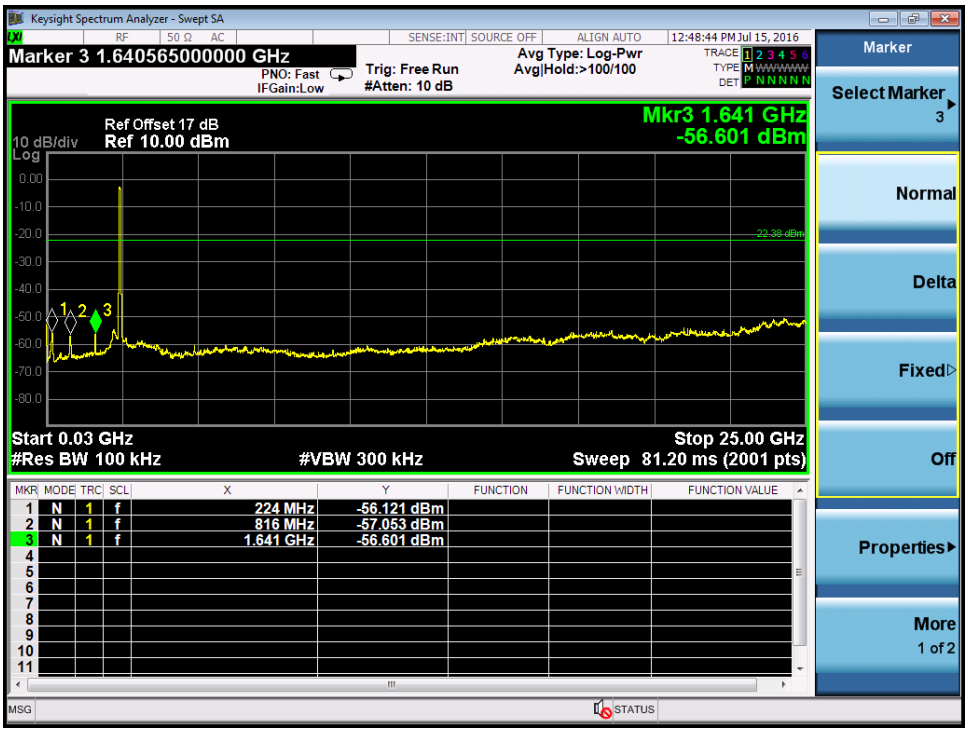


Figure 43: Conducted Spurious Emission, Ant 1, 11b, 2412MHz

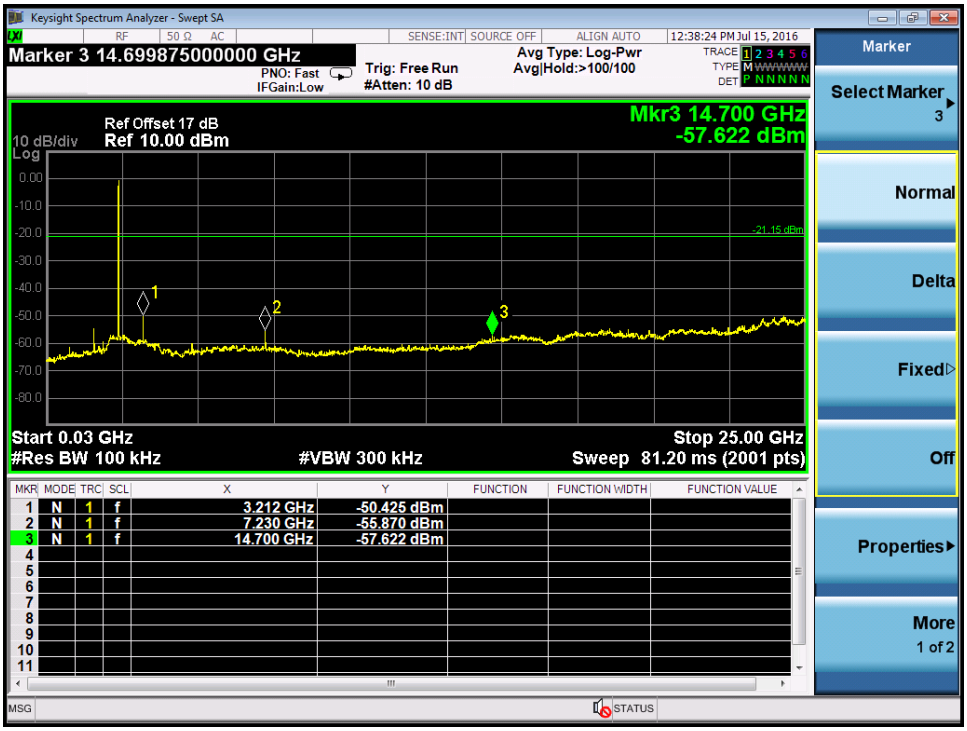


Figure 44: Conducted Spurious Emission, Ant 1, 11b, 2437MHz

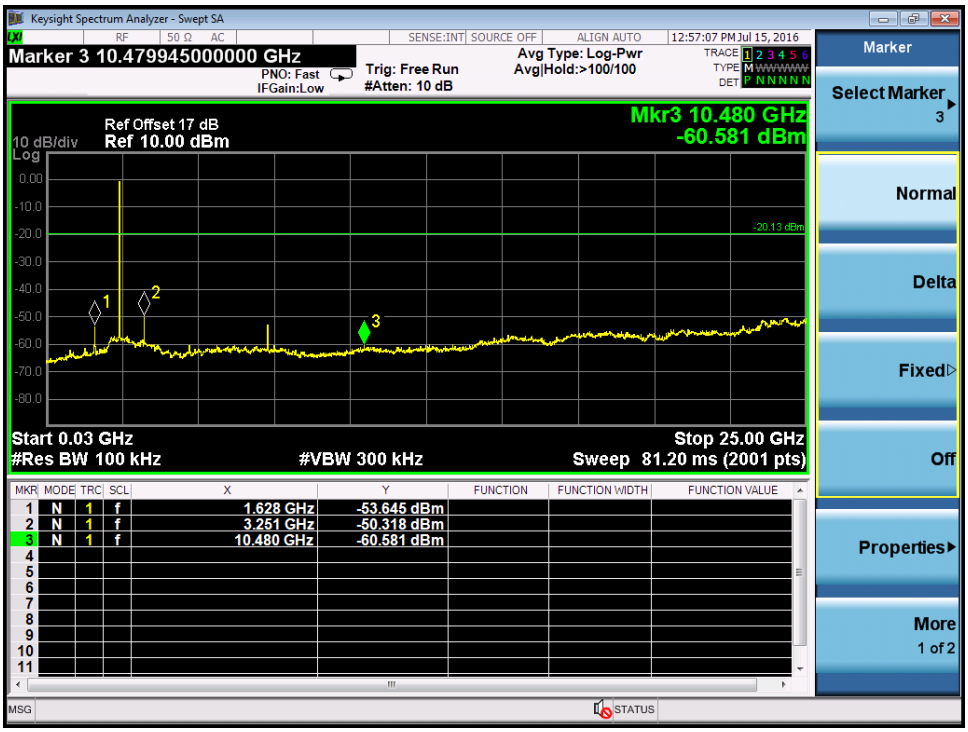


Figure 45: Conducted Spurious Emission, Ant 1, 11b, 2462MHz

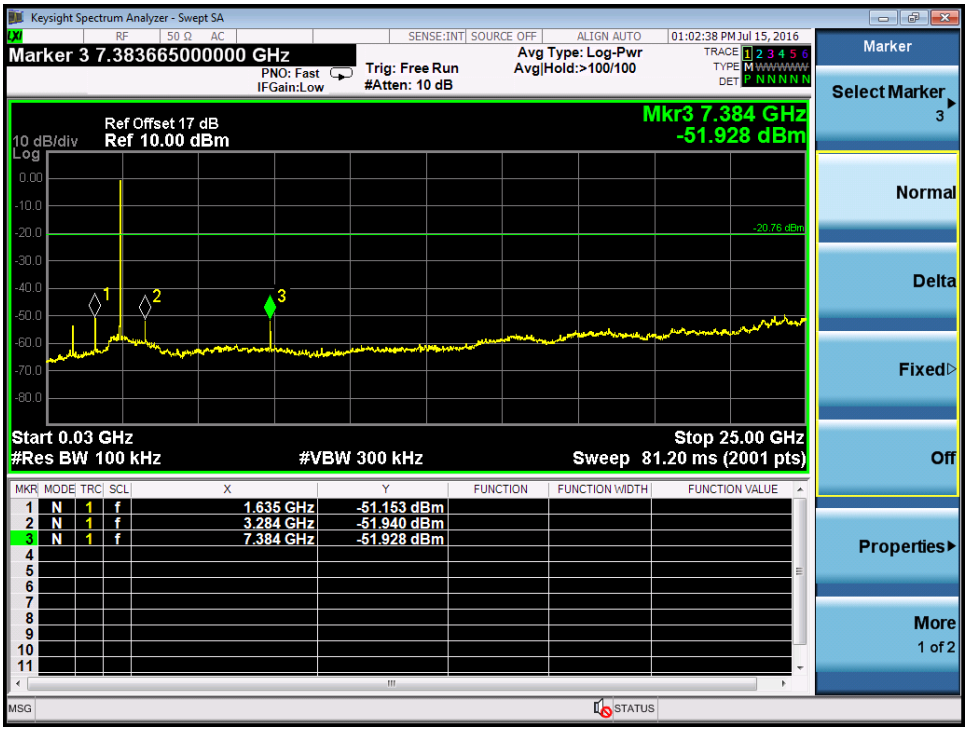


Figure 46: Conducted Spurious Emission, Ant 1, 11g, 2412MHz

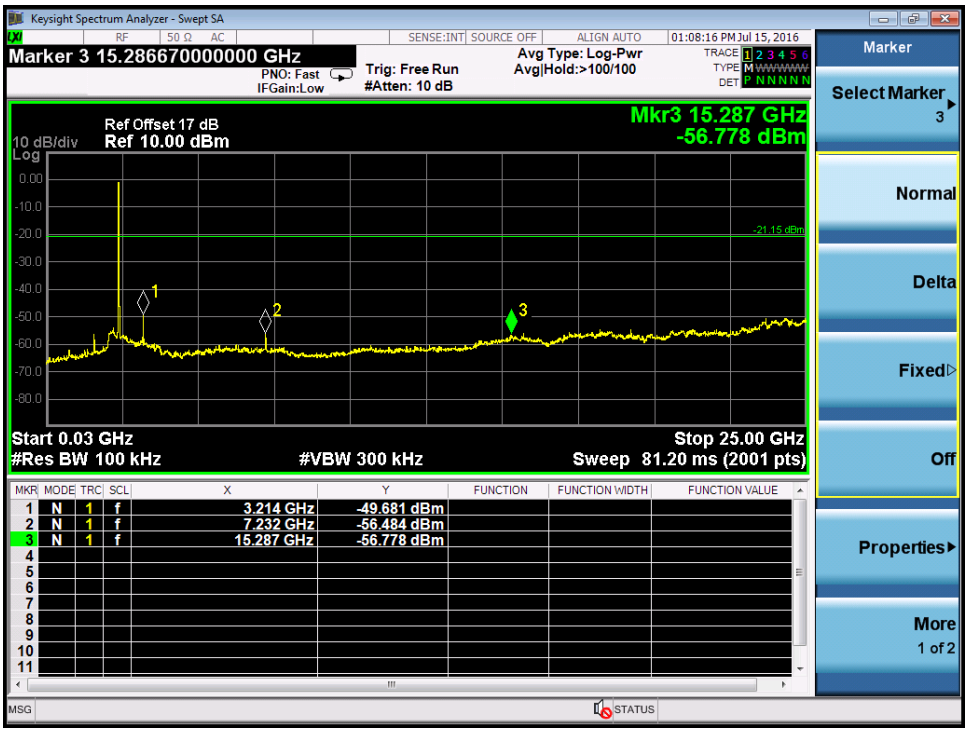


Figure 47: Conducted Spurious Emission, Ant 1, 11g, 2437MHz

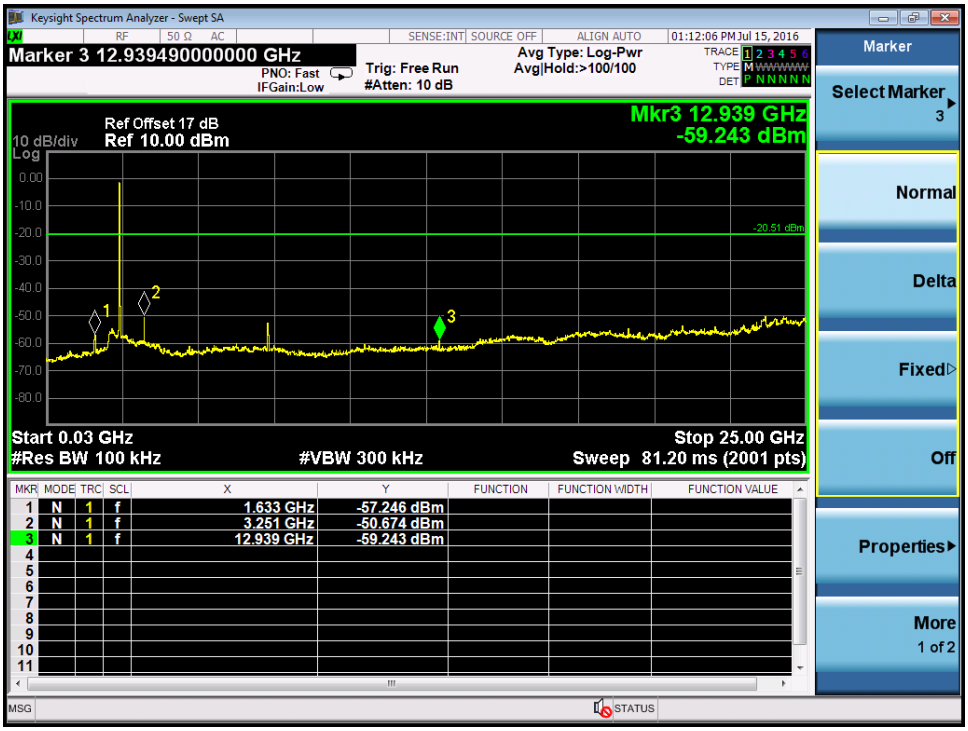


Figure 48: Conducted Spurious Emission, Ant 1, 11g, 2462MHz

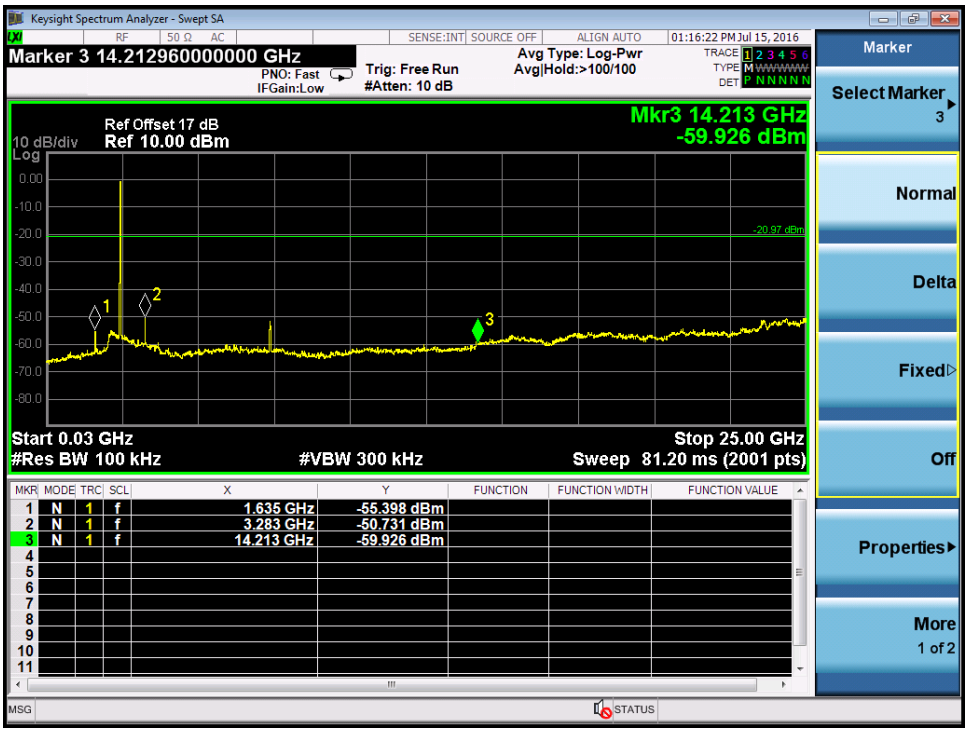


Figure 49: Conducted Spurious Emission, Ant 1, 11n-HT20, 2412MHz

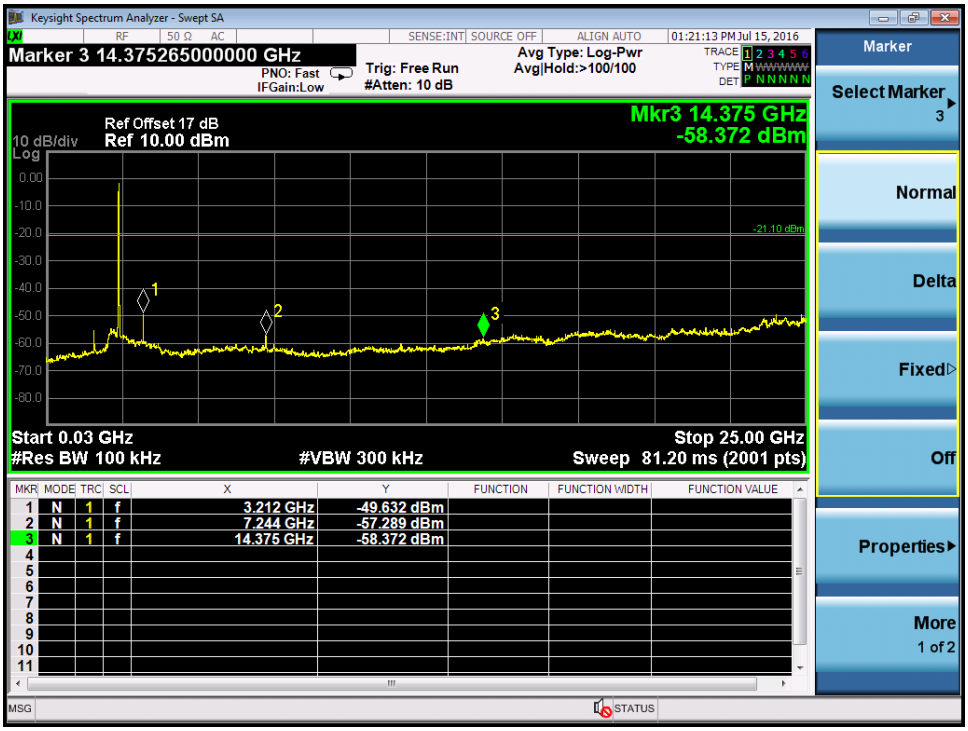


Figure 50: Conducted Spurious Emission, Ant 1, 11n-HT20, 2437MHz

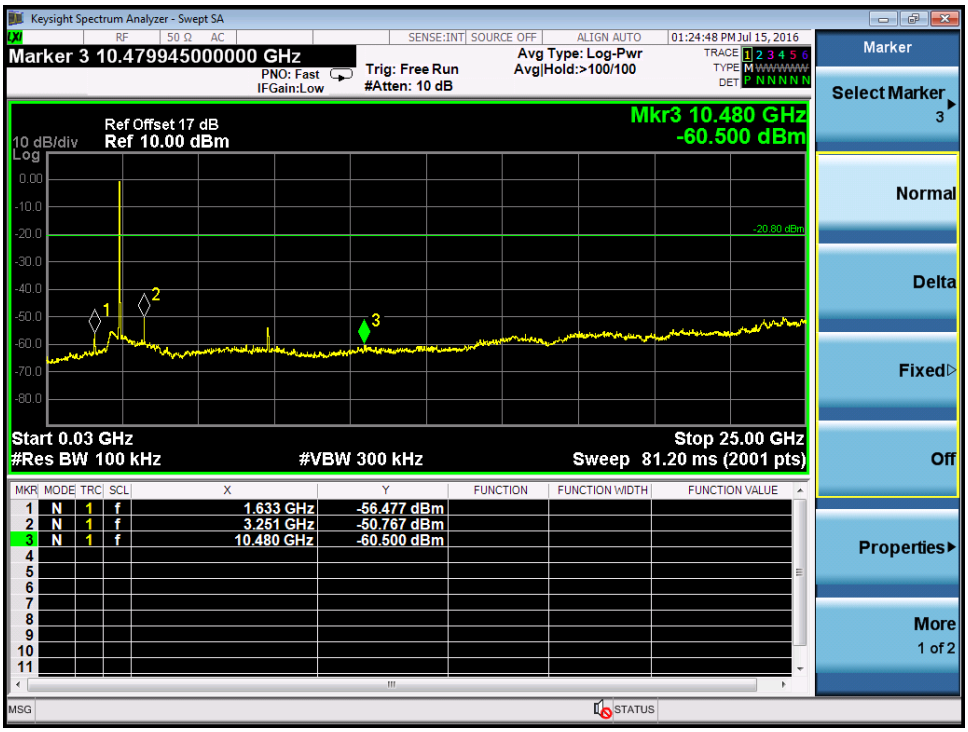


Figure 51: Conducted Spurious Emission, Ant 1, 11n-HT20, 2462MHz

Figure 52: Conducted Spurious Emission, Ant 1, 11n-HT40, 2422MHz

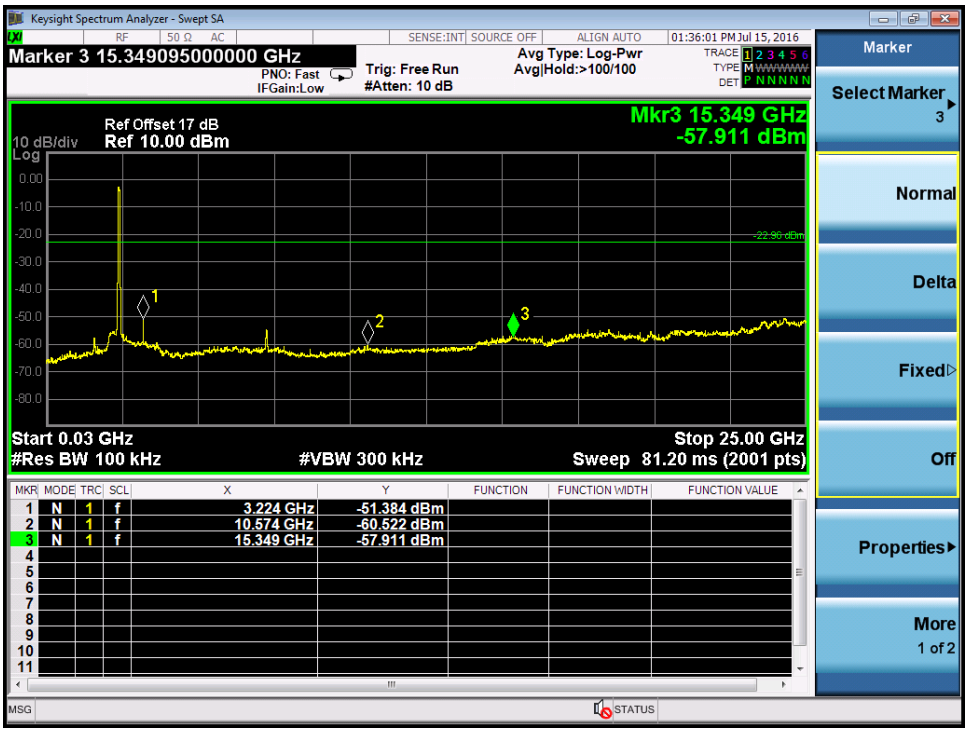


Figure 53: Conducted Spurious Emission, Ant 1, 11n-HT40, 2437MHz

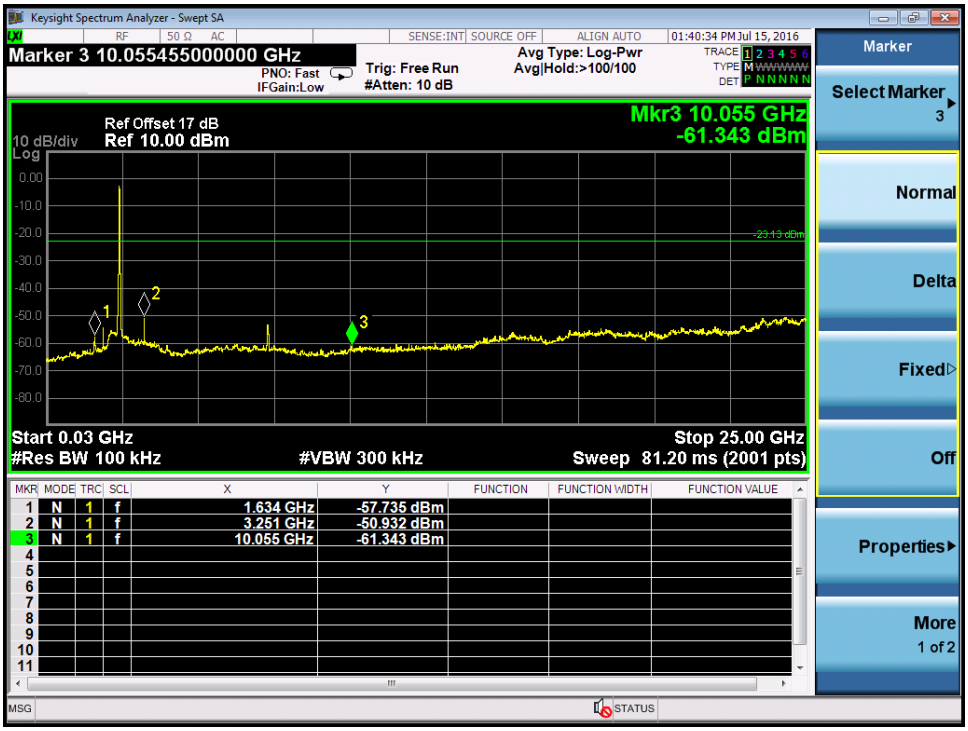


Figure 54: Conducted Spurious Emission, Ant 1, 11n-HT40, 2452MHz

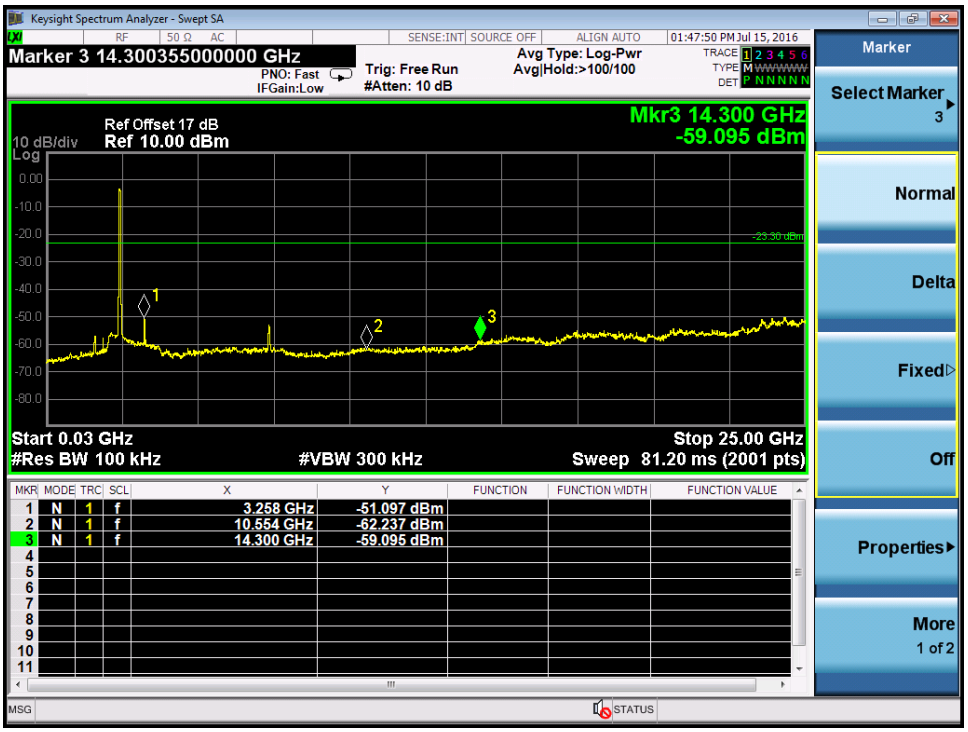


Figure 55: Conducted Spurious Emission, Ant 0+1, 11n-HT20, 2412MHz

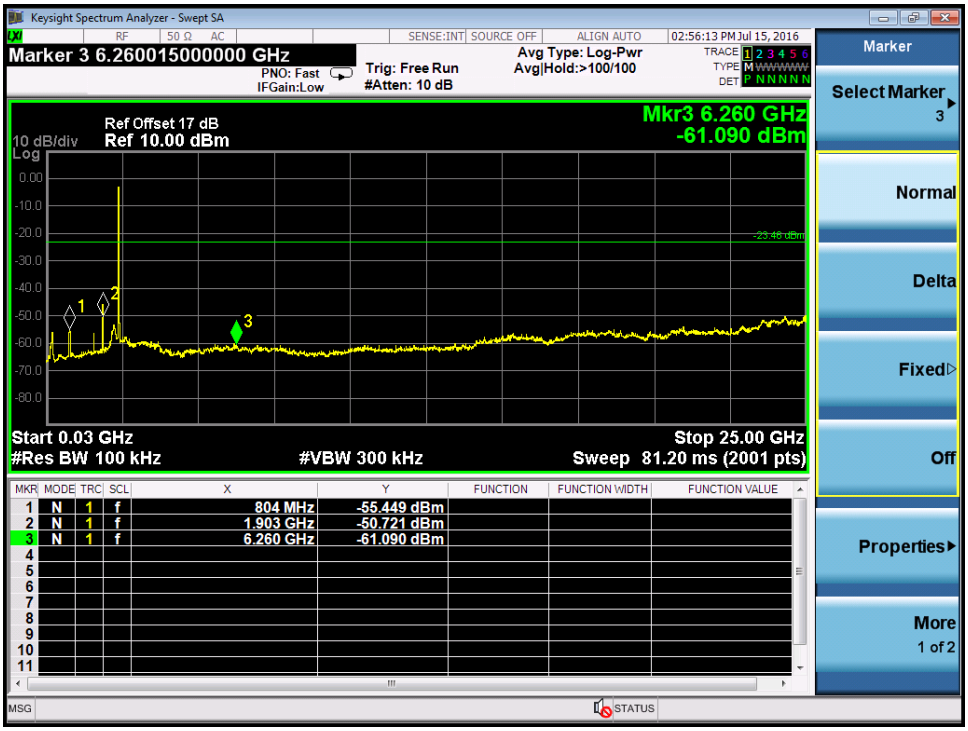


Figure 56: Conducted Spurious Emission, Ant 0+1, 11n-HT20, 2437MHz

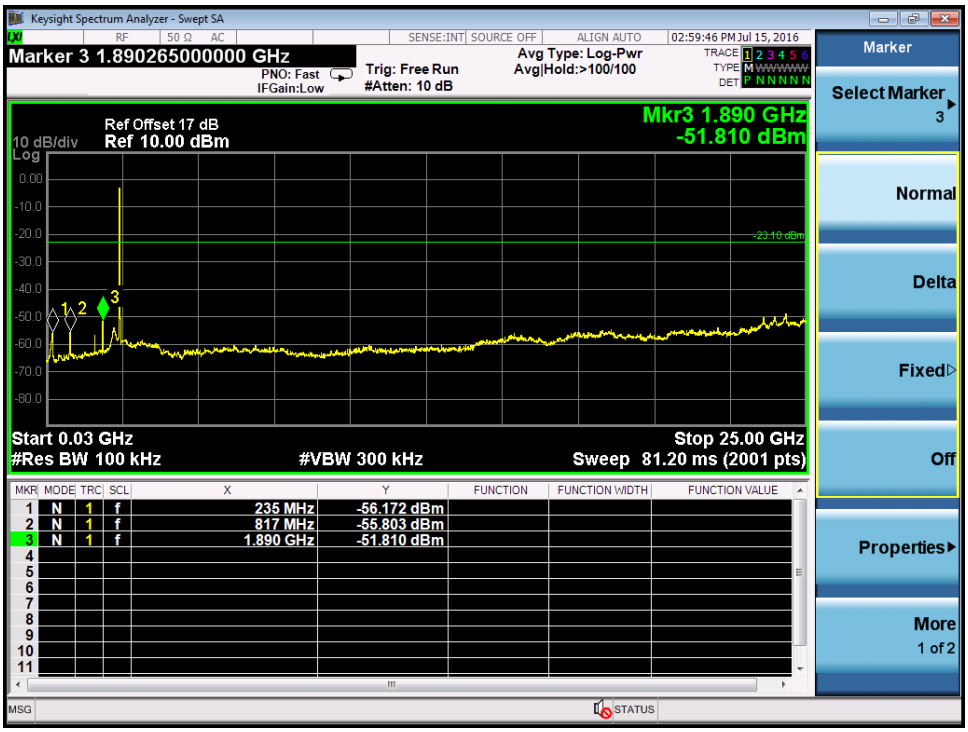


Figure 57: Conducted Spurious Emission, Ant 0+1, 11n-HT20, 2462MHz

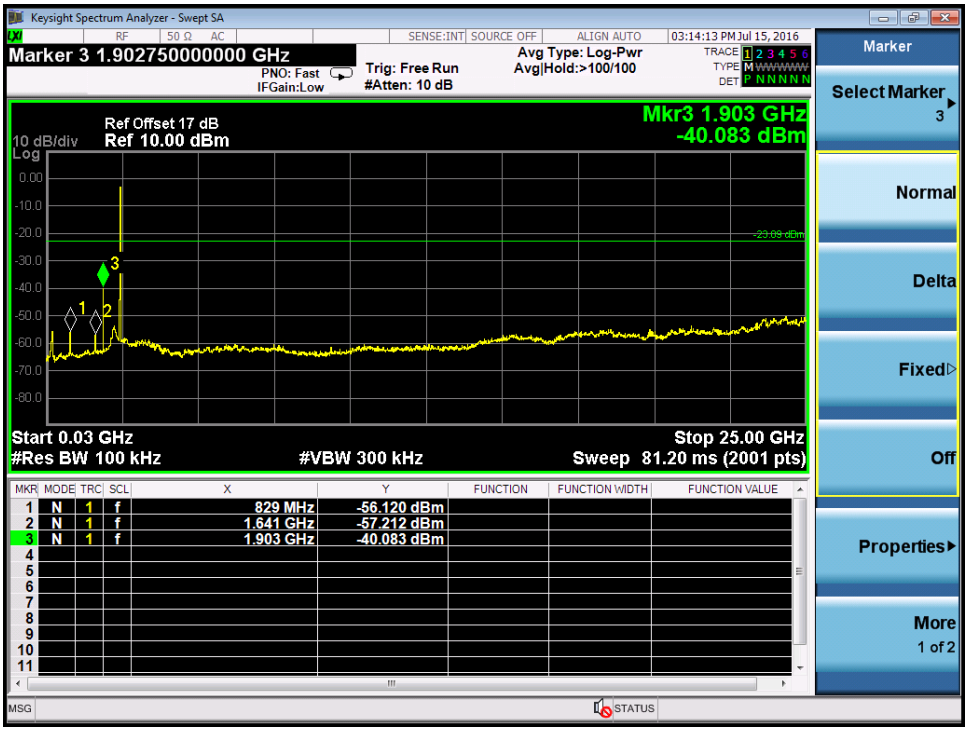


Figure 58: Conducted Spurious Emission, Ant 0+1, 11n-HT40, 2422MHz